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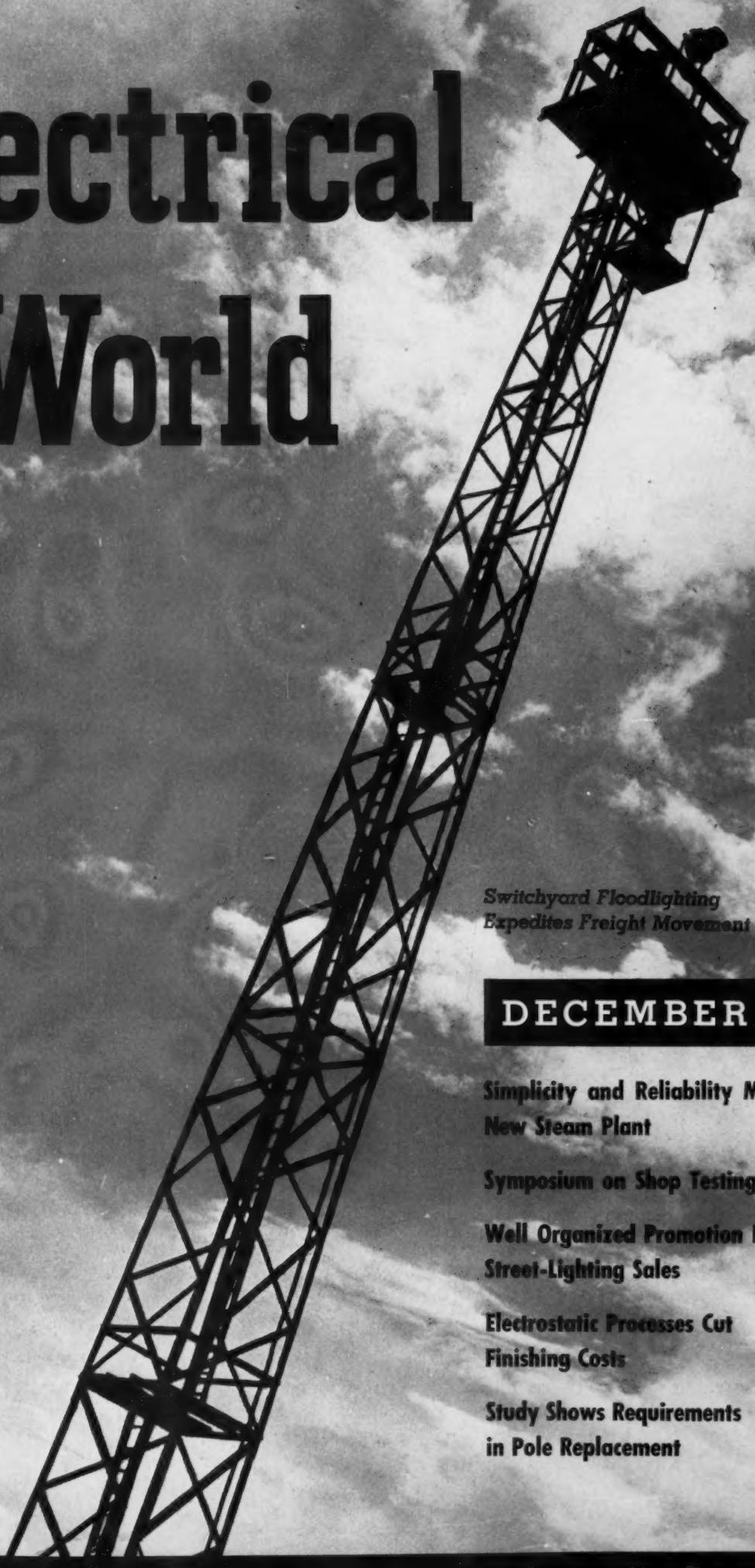

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DECEMBER 8, 1945

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Symposium on Shop Testing of Meters

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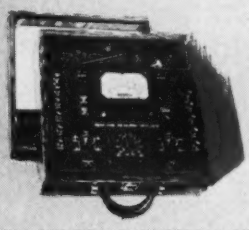

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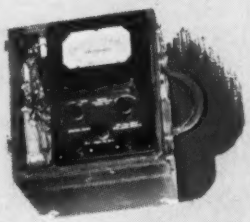

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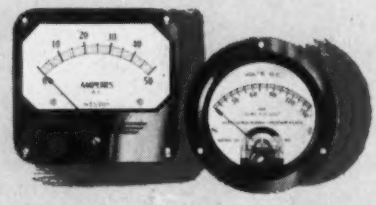

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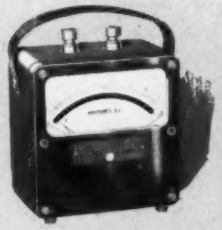

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Electrical World

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December 8, 1945 — Vol. 124, No. 23

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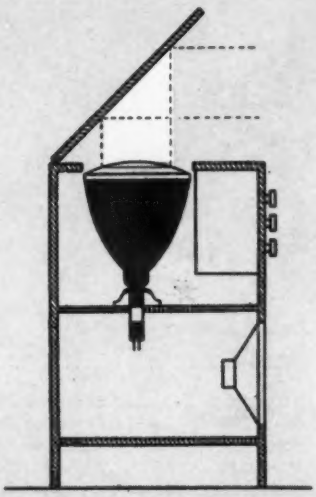
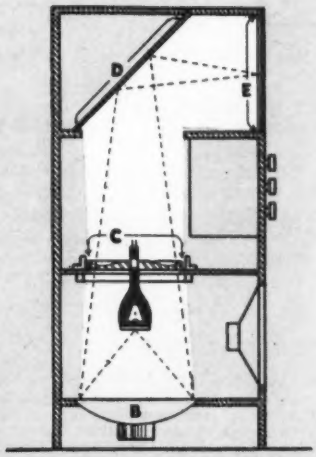


THE OLD WAY. Relatively small. With a direct-viewing cathode-ray tube, 12 inches in diameter, the picture you saw in prewar models was about 9 x 7 inches.



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This Lens Projection System utilizes a brilliant image on the face of the cathode-ray tube (A) projected down on the spherical glass mirror (B), then reflected up through the "Lucite" correcting lens (C) on a flat mirror (D) which throws a focused image on the translucent viewing screen (E)

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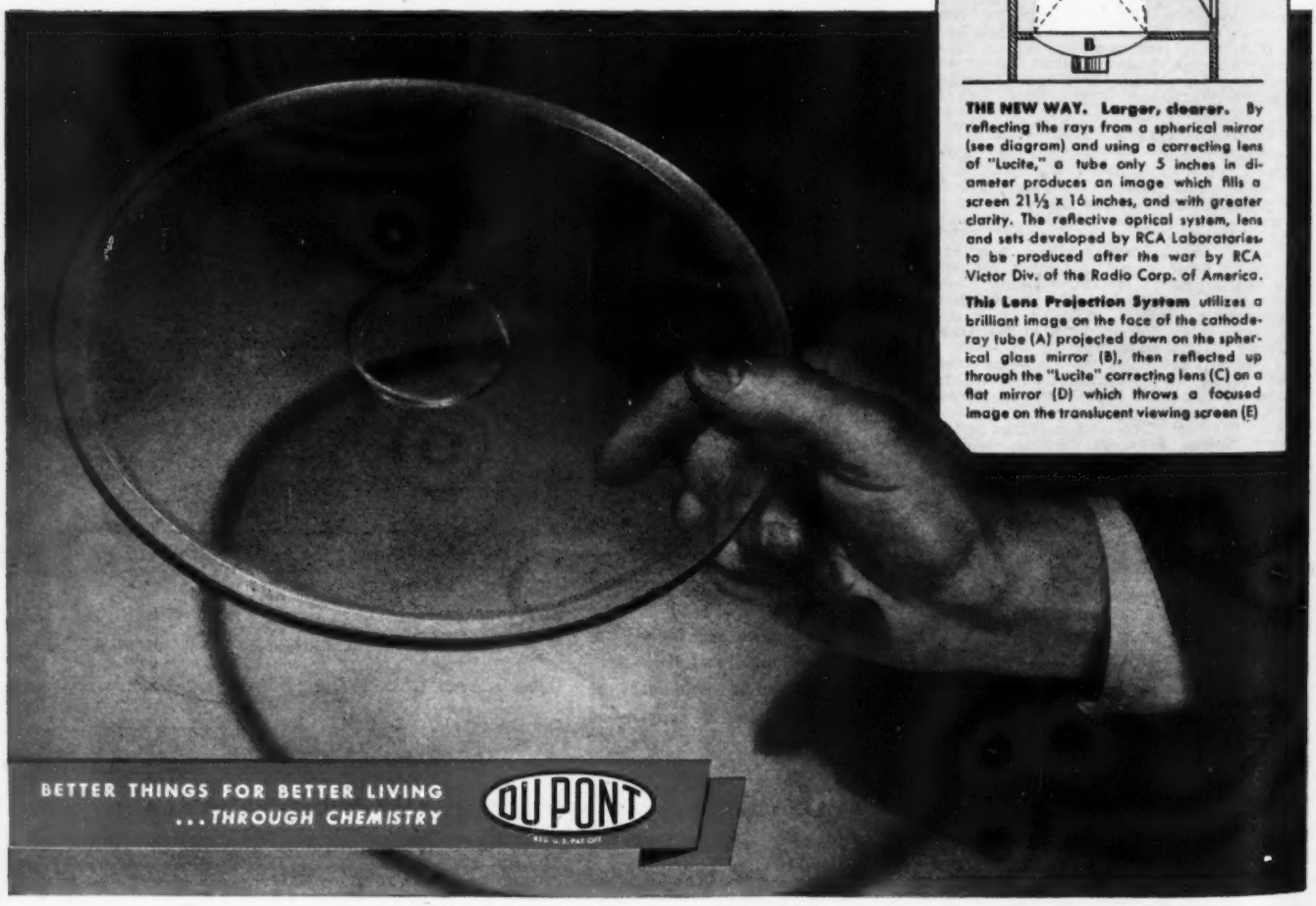


CONTROLLED ATOMS or CONTROLLED LIVES

SINCE August 6th when the first atomic bomb was released over Hiroshima, the American people have been subjected to a continuous barrage of pronouncements on the use and control of atomic energy. Some of this comment has been strident, and much of it conflicting. A considerable portion of it has been of sincere and constructive excellence.

It has not been easy to separate the wise counsel from the merely noisy, and it is small wonder that the minds of many are troubled and confused.

However, the sheer mass of discussion poured into press and microphone has awakened us all to the gravity of the issue. In terms of any problem on which Americans ever have been called to exercise a judgment—This is It!

Even the dullest now recognizes that atomic weapons hang over modern civilization like the Sword of Damocles, and understands in some measure how fragile and taut is the hair of political balance that holds it suspended.

From this point on, we need the coolest and most carefully considered judgment that can be brought to bear. Discussion highly charged with emotionalism will but increase the tensions both at home and abroad, and render wholly insoluble a delicately intricate problem.

What Is The Problem?

The major outlines of that problem now are coming into focus in understandable terms:

1. The scientists have opened up a new and virtually unlimited storehouse of energy, and the engineers have discovered how to turn it into a military explosive incomparably more powerful than any we have known. We know that this energy may also be used to produce heat for useful power, and we suspect that the radioactive substances produced by the process in hitherto unimagined quantity may also have medical, industrial, and other constructive applications.

2. Terrifying as have been the demonstrations of the atomic bomb thus far, we know that they are as nothing in comparison with its potential destructiveness. The explosive force of individual bombs can be increased tremendously, and means for their effective delivery to predetermined targets in wholesale quantity already are at hand. The experts tell us that no practicable means of interception can be devised, and that reprisal in kind probably will be the only answer to an enemy attack with atomic weapons.

3. So far as we can see now, even successful retaliation would be at best an answer of hollow effect. Any two nations each having wholesale stock-piles of bombs could accomplish the practical destruction of each other. Since a first treacherous blow might well constitute an enormous advantage, a nation actuated by a ruthless urge to conquest or revenge might have the best chance of survival. But since the widest possible dispersal of bombs and launching units would be dictated by the strategy of atomic weapons, it is doubtful that one nation could destroy another without itself suffering destruction. On both sides the major centers of population could be wiped out, and the nation of least concentrated industrialization and commerce would suffer least. However, no one can be sure that the concentrated explosion of as many as 20 thousand atomic bombs would not poison the atmosphere of the world to an extent that would be fatal to great masses of population, not only within the country bombarded, but perhaps in the country which launched them.

4. The problem is further complicated because, so far as we know now, any large-scale commercial use of atomic energy as a power source is more or less inextricably linked to a potential military use. It is true that, if atomic power becomes economically feasible (which is by no means certain for a long time to come), it would require only low-grade concentrates of fissionable material, which would need further elaborate and costly processing before reaching explosive potential. But the process of producing such low-grade concentrates constitutes perhaps two-thirds of the industrial effort required to make effective bombs. It follows, then, that if nations were to equip themselves to produce large quantities of low-grade concentrates for power generation, the effort required to develop large-scale bomb production would be materially reduced. Moreover, the maintenance of an effective inspection to police agreements not to produce bombs might be forbiddingly difficult if atomic power generation were allowed.

5. In addition to the major problem posed by the use of atomic bombs in international war, any nation which produces or possesses such bombs, or the fissionable materials with which they are loaded, faces still another in the danger of their falling under the control of paranoid elements in its own population.

What Are We Going To Do About It?

We face the hard fact that we have produced a weapon capable of destroying whole nations—perhaps even the whole world. Although we were importantly aided in its development by the nationals of other countries, we, together with Great Britain and Canada, now must take the initiative in deciding what shall be done with it. We have only two choices. We can try to keep this weapon as a monopoly of our own, or we can try to place it under broad international control.

Can We Keep It To Ourselves?

If we know one certain fact about the atomic bomb, it is that it cannot long be held as a monopoly of those nations which produced it.

If Nazi Germany had succeeded in developing the weapon first, it probably would have attempted to achieve world dominion, with utter destruction as an alternative. Such a course is not within our range of choice. It violates every principle for which we stand.

Much reckless nonsense has been uttered concerning the inability of other nations to master the scientific, engineering, and industrial problems involved. It is the virtually unanimous opinion of those who worked on the project that several nations today are fully equipped in science, engineering, and industrial organization to produce atomic bombs and to provide the means for launching them. At least one of these nations, Russia, has also access to an ample supply of the necessary raw materials. The only debate is over whether it would take three, or five, or ten years for her to marshal her resources to produce bombs in multiple thousands. Once such an atomic race were on, we have no reason to believe that Russia might not divert more resources to the task than we ourselves should be willing to put into it.

Additional nonsense is talked as to how we might attempt to cope with the problem of living in a world in which mutually suspicious or hostile nations faced each other, with stores of atomic weapons on both sides. We hear talk of dispersing our cities and even of moving underground. No one has seriously reckoned the difficulty or the cost of following such counsel of despair. Still less has anyone appraised the neurotic effect upon men's minds of living by any such preposterous formula, under continuously mounting tension day after day, and year after year.

Certainly, if we could find no way to prevent the competitive production of atomic weapons, we should be driven at least to the selective dispersion of our bomb-launching facilities, of certain key industrial establishments, and of our centers of government and governing personnel. We should be forced, also, to change our traditional requirement that only Congress can commit us to active war. We should be forced to organize ourselves as a police or military state, with our scientists regimented and muzzled, with all of us under constant surveillance against the smuggling and planting of time-bombs, and constantly alerted against attack through the air.

Before we commit ourselves to any such intolerable procedure, we should be mad not to explore all possible means for making it unnecessary.

The Only Feasible Alternative Is Effective International Control

This cardinal principle has been recognized in the statement of November 15th, issued jointly by President Truman, and Prime Ministers Attlee and King. Their statement frankly concedes that against atomic weapons there can be no adequate military defense, that no nation can command a monopoly of such weapons, that responsibility for eliminating atomic energy as an instrument of war and for devising safeguards over its use for the advancement of science and other peaceful and humanitarian ends rests upon the civilized nations of the world.

They propose that a commission be set up at once under the United Nations Organization to make recommendations: (a) for extending between all nations the exchange of basic scientific information for peaceful ends, (b) for control of atomic energy to the extent necessary to ensure its use only for peaceful purposes, (c) for the elimination from national armaments of atomic weapons and of all other major weapons adaptable to mass destruction, and (d) for effective safeguards by way of inspection and other means to protect complying states against the hazards of violations and evasions.

Already criticism is leveled at the wording of the statement, at alleged omissions, at the wisdom of choosing the United Nations Organization as the medium through which to seek agreement in view of the weaknesses of the UNO Charter.

None of these issues should be crucially important. What matters is that an invitation has been issued in good faith for the nations of the world to meet and decide upon means for assuring the elimination of weapons, the existence of which no one can afford to tolerate.

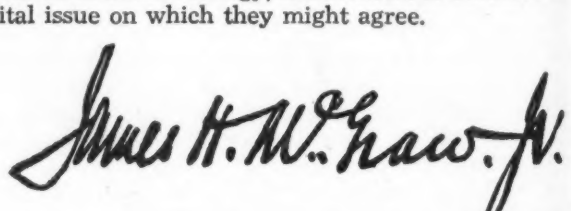
The decision cannot be other than international; it will require the best thought of the best brains the world can muster. The smaller nations have an equal stake with the large, and from them may well come the most fruitful suggestions. But Russia now holds the key to the success or failure of our proposal. If she accepts our invitation, no other nation will refuse.

Alternatively, there will be an international armament race paced by atomic weapons. It will mean an end of free science, a severe policing and regimentation of international travel and trade, and innumerable restrictions upon those individual freedoms which we have just fought so desperately to preserve. This is the dismal prospect if we fail to arrive at a genuinely international accord on the control of atomic energy. But even this interval would promise to last only for an uneasy period, until someone started pressing the push-buttons on the panel-boards of extinction.

The only permanent solution lies in finding means to eliminate war itself. That we cannot hope to achieve overnight, but we can, and do hope that the nations will now agree to eliminate atomic weapons and their radioactive by-products as instruments of war.

If they do that, we can move forward more surely to the constructive development of the incalculably valuable resources that science has newly opened to our use. And, we can hope also for a progressive improvement in international understanding.

Unless the nations can reach agreement on this paramount issue of atomic energy, it is difficult to conceive of any vital issue on which they might agree.



President, McGraw-Hill Publishing Co., Inc.

Electrical World

DECEMBER 8, 1945

Power for Peace

RECENT REPORTS from Russia indicate that the U.S.S.R. is convinced that electric power is of fundamental importance, both in terms of national economy and of national defense. A five-year program calls for doubling generating capacity. Such a program, if continued for only a few five-year periods, might find Russia's power resources in the same world position that her military resources were after a series of five-year programs preceding the war.

Today America leads the world in electric power generating capacity and in energy usage per capita. Because of these two accomplishments, probably more than any other physical factor, we in this country enjoy the highest all-around standard of living and income per worker and at the same time have a capacity to produce in war that is second to none.

The recent resumption of electricity output figures by Great Britain shows that from 1938 through 1944 the generated kilowatt-hours increased some 57 percent. During that same period the output in this country doubled. On a per-capita basis, Great Britain's output rose from 504 to 825 kw.-hr., while ours increased from 897 to 1,672 kw.-hr.

In other words, while at the outbreak of the war we had 78 percent more electricity behind every person than Great Britain, by the end of the war we had more than twice as much. That is one way of making a comparison but another way is to say that Great Britain by the end of 1944 had a per-capita output equal to ours of 1938, only six years ago.

Considering the difficulties under which our ally labored during the war, this improvement is remarkable. That it will be greatly bettered and shortly is indicated by the thinking of the party in power.

What does it all aad up to? Simply this, that America, while out in front today by a wide margin, cannot expect to stay there except by programs for expansion of power utilization that more than match those of other countries. This is not a race of power politics but a determination on the part of other countries that their people shall enjoy a scale of living that is equal to ours and at the same time shall be provided with a national defense that will be adequate against aggression by an industrially strong nation.

It may be wishful thinking, but we cannot help feeling that such a competition will be much more effective in promoting world peace than any great armament race. People who have, as a rule, are less interested in starting wars than people who have not.

Other nations learned that America's great strength was its ability to do the impossible in production. And they also learned that this was possible only because of the instantly available power behind the workers in amount equal to any demand made upon it. Never was power too little or too late.

If we in this country also see this as clearly as do our two great allies, then we will lose no time getting into this international race for power —not power over peoples and other nations, but power for better living, power for national defense—power for peace.

Planned Promotion Sells Planned Street Lighting

Well organized sales program, resumed after pre-war start, brings in post-war street lighting business for Duquesne Light—Effective sales aid from demonstrations of lighting equipment

L. H. LINGEMANN and F. B. MAHON†, Duquesne Light Co., Pittsburgh, Pa.*

FOR YEARS the Duquesne Light Co. has been interested in assisting municipalities in improving street lighting and through its municipal sales division has worked with public officials towards better street illumination. However, prior to 1939 there was no over-all educational or promotional program to further the improvement of street lighting despite the fact that the company had promotional and load-building programs in all of its other sales divisions. There were plans which included sales campaigns, direct mail folders, advertising and demonstrations as well as active solicitation in the residential, commercial and industrial markets, but outside of the contacts of its municipal sales representatives, very little was done to develop street-lighting load. Then some thinking was begun.

Long Range Program

As a result street-lighting sales promotion was given special study in 1939 and after considering all the factors involved—profit, public relations and manpower—it was decided to draw up plans for a much broader promotion of street lighting in the territory served by the company. It was recognized that selling street lighting could not be a "one call" proposition. Therefore, such a sales plan would be a long-range program designed to convince municipal officials, business men and civic leaders that modern street lighting would bring definite benefits to the community. As a result the company embarked on a five-year promotional program in 1939. Included in the program were newspaper advertising and news articles, direct mail literature, special street lighting publications, illustrated lectures and "Planned Programs" for municipalities for the improvement of their street lighting. Each part of the sales promotion program is described in more detail later in this article.

The Example of Edgewood

The program was initiated in 1940 with the publication of a booklet entitled "Edgewood Endorses Planned Street Lighting." This Borough adopted our "Planned Program" in 1939 and the entire street lighting of the community was modernized "according to the plan" in 1940. The old installation consisted of radial wave fixtures with 1,000-lumen lamps in the residential areas and diffusing globes equipped with 10,000-lumen lamps in the business districts. The residential streets were relighted by the installation of 4,000-lumen lamps in modern directive fixtures and the lights in the business areas were replaced with the same type of modern fixtures using 6,000-lumen lamps. Each street was relighted according to its traffic and protective needs following Illuminating Engineering Society recommended practices. No lamps smaller than 4,000 lumens were installed except a few of 2,500 lumens in radial wave fixtures in alleys. As a result of following the recommendations of the "Planned Program," Edgewood is now one of the best lighted small communities in the country. The Edgewood booklet has an artistically designed cover in color, is printed on high quality paper, and is well illustrated with reproductions of photographs and sketches. The booklet describes the steps taken by the Borough in making the street-lighting improvement and the benefits obtained. It carries a testimonial by the Burgess and features "before" and "after" night photographs of typical streets in Edgewood.

We had barely started on the progrom which had been set up, when it was discontinued because of the war. However, some "Planned Programs" for street lighting were developed during the war years so that prompt action could be taken after the war. After the end of the war in Europe and victory over the Japanese appeared certain, the sales promotion program was resumed. Many of its features have been put into operation during the past few months.

Advantages and Benefits

The "Planned Program" is a semi-engineering report consisting of two parts. The first part, entitled "Why a Planned Program," is purely promotional or informative and is devoted to a presentation of the benefits of good street lighting. Although this portion points out the traffic safety features of good street lighting, the many other advantages are also emphasized, such as community development, civic pride, protection against crime, stimulus to retail trade and increase of real estate values. Featured here also is a reproduction of a testimonial letter, on borough stationary, from the Burgess of Edgewood, telling of the many benefits his community has obtained by adopting the planned program of street lighting.

The promotional part of the

* Director, Municipal Sales.
† Sales Promotion Representative.

"Planned Program" includes a page of charts or graphs which give, at a glance, a comparison between the proposed installation and the existing street-lighting system. The charts consist of pairs of rectangular blocks, set side by side, and show the present and proposed number of luminaires, the total rated lumens, the total effective lumens, the effective lumens per dollar and the average visibility rating.

Lighting in Other Towns

Included, also, are "before" and "after" night photographs of streets in local communities where street-lighting improvements have been made. We have found that there is a great deal more interest in photographs of street-lighting improvements in adjacent towns than in photographs of installations in cities in other parts of the country. Showing photographs of street-lighting improvements in neighboring municipalities has been very effective because of the friendly rivalry that exists between these communities. Street-lighting modernization in one municipality has often influenced favorable action in bordering communities.

The second part of the "Planned Program" is entitled "The Plan" and gives a detailed appraisal of the existing street lighting as well as an outline of the improvements that will be necessary to bring the street lighting up to I.E.S. standards. Each street is listed with its classification (residential, business, traffic thoroughfare, etc.), the number of luminaires now installed on the street, the generated lumens, the net annual cost and the effective lumens per dollar. The recommended lighting for each street is tabulated on the same sheet so that the reader obtains at a glance a good idea of the improvements that are necessary to bring the street lighting up to standard. Included also is a small map of the municipality showing the street classifications in various colors. The report is bound in an inexpensive but dignified appearing cover and a copy, with a letter signed by the municipal salesman handling the account, is presented to each municipal officer. This report does not include detailed blueprints for the street-lighting improvements. These are given only to the officials responsible for the actual installation of equipment at the same time that the "Planned Program" is presented. A "Planned Program" is prepared upon request for any municipality in our territory interested in improved street lighting.

The value of the "Planned Program" is obvious. It puts in the hands of municipal officials a definite plan for improving the community's street lighting system and it gives them logical reasons in the way of benefits for making such expenditures. Then, whether they wish to install a single street light, relight a section of the community, or modernize street lighting in the entire municipality, they can "do so according to the plan." Naturally, we have featured "Planned Programs" in our advertising and promotional material, stressing "do it according to a plan" when making street-lighting improvements.

Demonstrations Carefully Planned

Street-lighting demonstrations are another very important part of the over-all sales promotion program. These demonstrations have been designed for presentation before meetings of municipal officials or civic organizations such as Kiwanis, Rotary and Lions Clubs and business groups. Nine such meetings have been held within the past few months and have been found very effective.

After considerable thought as to the type of presentation to be given at these meetings, a talk and demonstration was adopted which would be both entertaining and informative. The entertaining part of the program includes a talk and demonstration on the development of light sources from their primitive beginning up to the many different types of lamps in use today. A demonstration kit containing five incandescent lamps is used to show the evolution of this type of lamp. Emphasis is placed on the improvement in lamp efficiency. On display and discussed by the

OFFICIALS OF THE TOWN of Westview and of Ross, McCandless, and Kilbuck townships look over modern street lighting equipment and other developments in the lighting art. In the top picture, L. H. Lingemann shows the construction of a luminaire; in the bottom one F. B. Mahon (second from right) demonstrates the new self-contained sun lamp →

LIGHTING DEMONSTRATIONS to Lions, Rotary, Kiwanis and other clubs are part of the program of promotion. There were 80 members of the Ambridge and Aliquippa Rotary clubs at this meeting

lecturer are the various types and sizes of fluorescent lamps, an infrared lamp, an under-water lamp, an ultraviolet germ-killing lamp, as well as interesting war developments such as the flashlight gun signal and the emergency mirror which is standard equipment for pilots and jungle troops. Also on display are high intensity mercury vapor and sodium vapor lamps. Attention is called to the efficiency of these latter light sources and their possible application in street and highway lighting. This part of the demonstration ends with a spectacular display of "black light," showing its effect on fluorescent-treated materials.

Other Lighting Promoted

Entertainment was included as part of the demonstration because it was thought that a lecture on street lighting alone, involving traffic accident statistics, mounting heights, spacing of fixtures, etc., would be rather technical and dry for this type of meeting. Furthermore, the men attending these demonstrations would be merchants, professional people and industrial executives and, therefore, they would be interested in other types of lighting equipment also.

The street-lighting display includes a radial wave fixture, an older type diffusing unit, and two modern directive type fixtures. All of these fixtures are wired for multiple service and are lighted for the demonstration. During the presentation the various features of these street lights are brought out and those attending the meeting are invited to inspect the equipment at first hand after the meeting has adjourned. We have also been using a slide film taking about ten minutes. The film has been used because it emphasizes the need for engineering design in obtaining a good street-lighting installation and ties in with our "Planned Program."

Information Is Appreciated

Our experience with these demonstrations has been highly satisfactory. All of them have been dinner meetings. We pay the cost of the meals when we arrange the meeting and invite the guests. We do not pay for the dinners when the demonstration is given before a regular meeting of a service organization. Invited to attend meetings of municipal groups are municipal officials, such as the Mayor or Burgess, members of Council or Board of Supervisors, the Secretary, the Treasurer, the Solicitor, the Police and Fire Chiefs, and sometimes citizens who take an interest in civic matters.

Time after time, municipal officials have expressed their thanks for having the opportunity to attend these meetings. For many of them it was the first time they had seen street lights at close quarters and had the chance to "look inside them." They had often seen them on poles or standards—25 or 30 ft. in the air. A remark that always has been heard at these meetings is, "I didn't know these fixtures were so big and well constructed. They look much smaller on the tops of poles." Another remark frequently made was, "We didn't know that you had to design a street-lighting installation and take into account the mounting height and spacing. We were of the opinion that you just hung the lights on the poles."

We are convinced that the demonstrations are creating good will for the company and that they will pay off in better street lighting. They have been particularly helpful to our municipal salesman because he invites the guests and he is chairman of the meeting in his district, all of which brings him closer to his customers.

The demonstrations and planned programs are supported by an organized advertising campaign. This includes newspaper articles and use of the "Newsletter" and the direct mail pieces of the Street and Traffic Safety Lighting Bureau.

Stories to Local Newspapers

In connection with newspaper publicity we have been using the local community papers as media for educating citizens on the value of good street lighting. Photographs of new installations and accompanying news items appear as feature articles. After a demonstration meeting is held in a community, a photograph and news item of the meeting are featured in the local newspaper. Our plans also include a series of articles on the benefits of good street lighting which will be passed on to editors of community newspapers to be used as feature articles. Eventually we may find it advisable to use paid advertisements in these same newspapers.

Four of the direct mail pieces prepared by the Street and Traffic Safety Lighting Bureau of NEMA will be released on a pre-determined schedule during November and December, 1945, and January, 1946. It is planned to release the literature in these months because communities make up their budgets during the early part of the year and it is believed that maximum effect can be obtained from these pieces if they are released in this manner.

Effort and Expense Justified

This over-all promotion program was put into operation early this year, starting with the demonstration meetings. The first "Newsletter" was mailed in May and "Planned Programs" have been officially adopted by five municipalities. One of these, namely Edgewood, has changed over completely, while the other four have started to change over. Although it is far too early to evaluate the full effect of this program, we believe that the results which eventually will be obtained will more than justify the effort and expense involved.

Electrostatic Processes Cut Finishing Costs

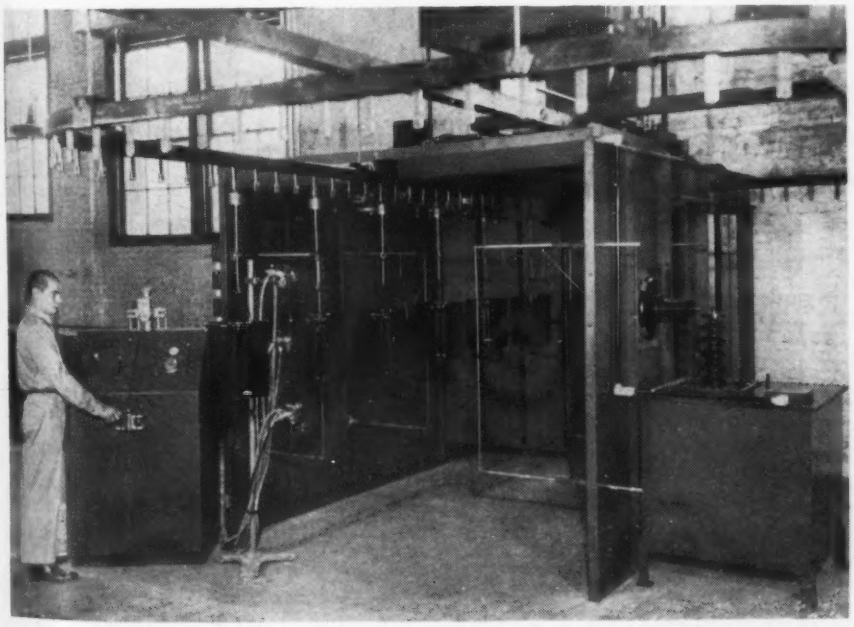
Principles of electrostatic attraction applied to dip and spray painting of industrial products save material and labor, increase production rates. Electrostatic spraying process an adaptation of the precipitation process to industrial finishing—Detearing process outlined

THE FUNDAMENTAL physical law that unlike electrostatic charges attract and like charges repel underlies a new electrical system, widely adopted by war plants since Pearl Harbor, that overcomes inherent handicaps of orthodox dip and spray-coating processes. Through its use large amounts of paint are being saved; more uniform finishes are being obtained at lower cost and with greater speed.

Older spray-finishing methods relied largely upon mechanical direction of the spray and volume of paint atomized, to obtain coverage. Often the uniformity of the coating was poor and considerable amounts of material, sprayed into the booth, never reached the work. Modern electrostatic spraying overcomes these handicaps. Paint spray, projected into a high-potential electrostatic field surrounding the work, becomes charged and is attracted to and deposited uniformly on the work, which comprises one electrode of the field. Very little paint is lost since overspray that misses one item on the conveyor is drawn to the next, instead of depositing on the booth or escaping through the ventilating system.

Similarly electrostatic attraction has been applied to dipping and flow-coating processes to draw off "tears" of surplus paint and so contribute to product uniformity. Work on the conveyor passes over an electrostatically charged grid which is opposite in polarity to the work. Surplus paint spurts from drainable edges of the work in minute streams along electrostatic lines of force between the electrodes.

Both these processes were developed by the Harper J. Ransburg Co., Indianapolis, in attempting to devise a way to save the paint lost in coating the company's peacetime line of ornamental stands, waste baskets, bread boxes and other household items. In casting about for a solution they struck upon a variation of the familiar Cottrell process widely used in generating stations to precipitate fly ash and dust from stack gases.



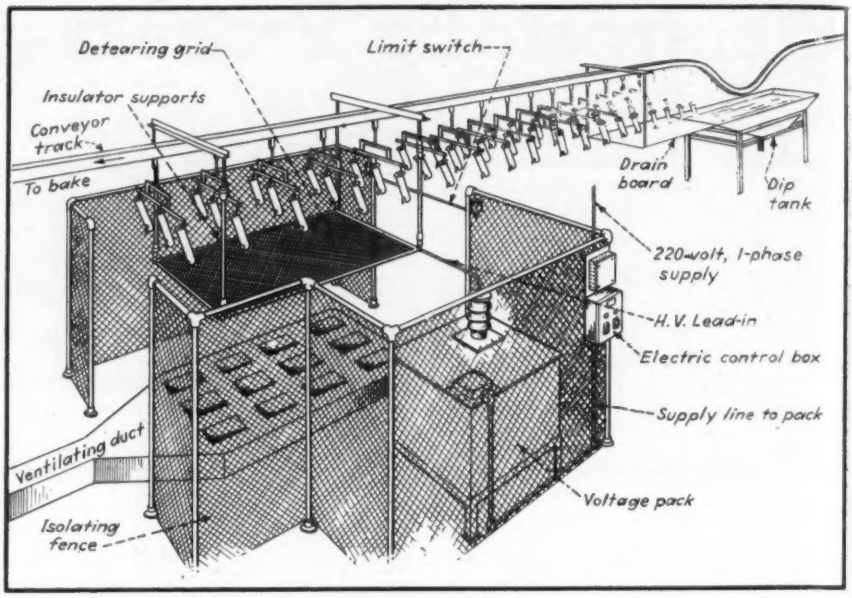
ELECTROSTATIC SPRAYING of 5-gal. paint cans in a laboratory set-up simulating an actual industrial installation which cut paint used from 800 to 330 gal. per day. At left is control panel; voltage pack at right. Note negative grid on either side of conveyor supported cans. Work and conveyor are grounded and positive

Electrostatic Spraying

Work to be coated by electrostatic spraying is suspended from a grounded conveyor. The grounded piece itself becomes by induction the positive electrode of a high-voltage electrostatic field. The negative electrode is a vertical grid of fine copper wires suspended 10-12 in. away from and parallel to the line of travel of the conveyor. A negative static potential of 100,000 volts with respect to the grounded work is impressed on grid, producing a strong uni-directional electrostatic field. Air in the vicinity of high potential, negative grid is highly ionized. Paint spray particles entering this electrostatic field become negatively charged by contact with this highly ionized air and are attracted to and precipitated uniformly on the exposed surfaces of the positively charged work. Practically all of the paint spray entering this high inten-

sity electrostatic field is forced over to the work. Very little deposits on the negative grid or escapes as overspray through the ventilating system.

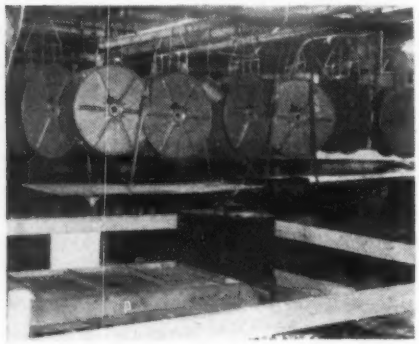
The ideal condition for precipitation of the paint occurs when the velocity of the spray is zero and the electrical forces of the field are entirely responsible for the precipitation. Under this condition the maximum "wrap around" effect of the electrostatic lines of force would be achieved. This condition is approached in practice by using a soft spray—10 psi. atomizing air pressure; directing the spray tangential to and against the direction of travel of the conveyor and locating the nozzles far enough outside the electrostatic field so that inertia of the spray is dissipated as quickly as possible by the electrostatic forces.



GENERALIZED ELECTROSTATIC DETEARING DESIGN showing typical arrangement of negative grid, voltage pack and electrical controls

Voltage Pack

High uni-directional potential for the electrostatic field is provided by a completely oil-immersed voltage pack consisting simply of a 220/130,000 volt high-impedance transformer and high-voltage, kenetron-type, half-wave rectifier tube having a separate filament transformer. Input rating of the voltage pack used for electrostatic spraying is 220 volts, 10 amp. In normal operation the voltage pack draws a single-phase load of 3½ amp. at 220 volts. Rated output voltage of the pack is 130,000 volts but normal operating potential seldom exceeds 100,000 volts. Short circuit current referred to the high voltage side is 10 milliamperes. Efficiency of the pack circuit is about 60 percent, power factor 70 percent, and will vary with installation conditions.



WAR PLANT installation of detearing apparatus used in coating signal corps reels. Negative grid and voltage pack are visible below line of reels

Minimum allowable operating spacing between the negative electrode (grid) and the grounded work for electrostatic spraying is twice the flashover distance or about eleven inches at 100,000 volts. This corresponds roughly to an average voltage gradient of about 10,000 volts per inch.

In electrostatic spraying equipment a clearance of 18 in. should be maintained between high potential leads and other electrical grounds in the vicinity. Smaller spacing decreases the efficiency of precipitation by allowing neighboring grounds to act as collectors in competition with the work, increasing the load on the unit. Other precautions to be observed in installing electrostatic equipment are listed herewith.

Applications

Electrostatic spraying can, in general, be applied economically where work volume justifies an automatic spraying installation. Application of the process is not restricted solely to conducting materials. Wood, paper, earthenware, plastics and even seaweed have been successfully spray-coated electrostatically.

The uniformity of the coating obtained by electrostatic methods is largely dependent on the surface contour of the work. The ideal object has a uniform and regular surface, like a cylinder. Paint will deposit uniformly on such a piece not only on the cylindrical surface but also on the top and bottom as well. Inner surfaces that are shielded electrically, however, cannot be painted unless special steps are taken to build up a field within the object. Similarly electrical shielding reduces ability to precipitate paint in deep recesses or crevices of an irregularly shaped object. Electrostatic lines of force tend to draw most of the paint to the protruding parts, "starving" the nearby recesses. This effect can be minimized in some cases by rotating the part and altering direction of the spray so that spray carries mechanically into the deep recesses.

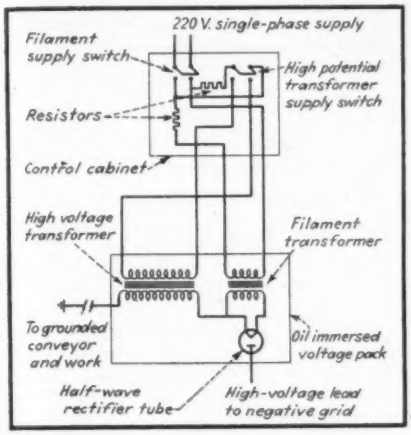
As a general rule application of electrostatic equipment to an existing automatic spray-coating installation will save from 40-60 percent of the paint formerly wasted, increasing the amount of paint deposited on the work from 50 to 70 or 75 percent.

Electrostatic Detearing

As in the spraying process the detearing process uses electrostatic attraction to draw excess coating material from drain-off points on the work, thus eliminating a serious cause of non-uniformity in coating applied by the dip process. Accumulated "fatty" edges or tears of surplus paint not only spoil the uniformity of finish but influence the design of drying oven which must be arranged to bake the heaviest sections of coating.

Electrostatic detearing interposes a labor-saving step in the conveyor line between the dip tank and drying

oven or tunnel. Leaving the dip tank, parts are conveyed over the usual drain board and allowed to air dry until surplus paint flow has practically ceased. The part then passes over an insulated conducting grid that is energized at a high d.c. potential. As in electrostatic spraying the work is grounded and positive. The grid is negative and at a potential of 85,000 volts above ground. Again spacing between grid and work is twice the spark over distance corresponding to an average voltage gradient of 10 kv. per in. The resulting



SCHEMATIC DIAGRAM of voltage pack used to produce high potential electrostatic field for spraying process and detearing process

strong attraction between the grid and the work, produced by the electrostatic field, causes excess paint to spurt from the drain-off points in minute streams dropping to the grid along familiar electrostatic lines of force. Time required for detearing most parts is between 15 sec. and 1 min.

Detearing Pack

Except for the lower voltage used (85,000 vs. 130,000) the voltage pack required for detearing is identical with that used for electrostatic spraying. Here again the 220-volt single-phase supply is stepped up to 85,000 volts in a high-reactance transformer and rectified with a hot-cathode, high-vacuum tube of the kenetron type. The negative output terminal is connected to the grid, the positive grounded to the conveyor line carrying the work. Short circuit current rating of the pack, referred to the high voltage side, is 5 milliamperes but the actual operating current is about 200 microamperes. Rated input of the totally enclosed, oil-immersed voltage pack is 220 volts, 5 amp. Operating load, however, is approximately 2 amp. Power factor is 70 percent.

The negative grid may be made from any conducting material and fitted to the particular application involved, giving consideration to the conveyor speed and article treated. Usually it is an expanded metal screen.

There are two limitations confronting this method of detearing. One is that the coating should not be sufficiently thermoplastic to cause flow during baking. Another is that the drainoff point should *not* have a large radius. It is essential that the part be hung in a manner to drain off the excess coating material from a section of small radius where field strength will be high and attraction forces proportionately great.

In general, electrostatic detearing can be applied successfully to any item in which the excess paint can be drained to an exposed, unshielded edge. It is applicable to all types of materials. Plastic handles, panels, ceramic molded pottery, metal airplane parts, glass tubes and wooden toys have been dipped and deteared successfully.

Safety Considerations

Experience with the process indicates that when electrostatic equipment is properly installed little hazard to either personnel or property exists. High reactance design of the voltage pack limits short circuit current of the 85,000-volt detearing pack to 5 milliamperes and the 130,000-volt spraying pack to 10 milliamperes, values well outside the lethal range. Shocks, while uncomfortable, are not considered a primary hazard.

Experience indicates that there is no undue hazard resulting from electrostatic spraying and detearing apparatus when installed in accordance with the 13 rules set forth in an informative report before the National Fire Prevention Association in May 1944 and presented with this article.

RULES FOR INSTALLATION AND OPERATION OF RANSBURG ELECTROSTATIC PROCESSES

1. Transformers, power packs, and all electrical controls are to be located outside the immediate painting area. (Not inside spray booths—well away from dip tanks, etc.)
2. The electric installation is to be in accordance with the National Electrical Code so far as it applies.
3. Electrodes are to be rigidly supported in permanent locations and well insulated.
4. Minimum spaces between electrodes and painted goods are to be at least twice the distance of the length of the possible spark-gap.
5. Installations are not allowed where goods being painted are handled manually. All goods subject to the processes are to be handled on conveyors and to be so fixed to the conveyors that the minimum spaces from goods to electrodes will be maintained under all circumstances.
   Also, guards to be provided where necessary to produce this result.
6. Automatic control should be provided to make the entire electrostatic equipment "dead" when vent fans and conveyors stop.
7. Standard ventilation shall be maintained for the areas containing the electrostatic apparatus; the fan motors for the ventilating system are to be connected in series with the voltage pack primary. (Rules for Blower, Exhaust and Ventilating Systems to apply.)
8. All painting processes supplemented by electrostatic apparatus shall be protected by automatic sprinklers or other approved automatic extinguishing systems.
9. Where necessary adequate fencing, railings or guards are to be provided to maintain safe isolation of the process from other work in the vicinity and to guard personnel.
10. Signs designating the work zone as dangerous as regards fire and accident shall be posted at the process.
11. Electrode insulators shall be kept clean and dry.
12. Drip plates and screens shall be removable and taken to a safe place for cleaning.
13. Cleanliness shall be maintained and stock or goods not stored within five feet of the process.

(Presented at the annual meeting of the National Fire Protection Association, May 8, 1944, by Mr. Benjamin Richards, Chairman of Committee on Finishing.)

Simple Design, Reliability Keynote Jennison Station-I

Largely built in severe winter weather, station burns small-size anthracite, reburns carbon in cinders—Electronic control of I.D. fans and stoker speed—Automatic combustion controls—Four stage regenerative cycle—Attendants paged anywhere by loud-speaker system

W. W. PERRY and WALTER GREACEN, 3rd. New York State Electric & Gas Corp., Binghamton*

POWER FOR THE AGRICULTURAL and dairy area in South Central New York will be augmented by capacity installed in the new Jennison Station at Bainbridge, named in honor of Ralph D. Jennison, president of New York State Electric & Gas Corp. Fuel will be anthracite from fields only 65 miles away. The stoker and the induced-draft fans will both be electronically controlled; the magnetic pulley on the coal-handling belt will have power from an electronic source. To avert use of scarce steel the bunkers are of reinforced concrete. Unburned particles suspended in flue gases will be recirculated and reburned. The initial installation consists of one General Electric 30,000 kw. turbine generator, and two Combustion Engineering Co. traveling grate stoker-fired steam generators of 200,000 pounds per hour steaming capacity each.

Construction of the project was carried on continuously through the winter of 1944-1945 in spite of severe weather conditions and limited manpower. In order to carry on construction of building walls, a temporary structure of insulating board was erected around three sides of the building, and the entire structure heated so as to permit laying of brick regardless of weather conditions. The plant is now ready to operate, 17 months after breaking ground.

Excavation areas were pre-drained by means of the well-point system whereby excavations were carried on 26 feet below normal river level without the use of sheet piling or shoring. This phase of the work was carried out under a separate contract with the American Dewatering Corp. Building and equipment are supported on a "boat" design foundation, thus eliminating piling.

Fuel is Anthracite

Low cost and availability of small size prepared anthracite made it the most economical fuel for this project. The present fuel contract calls for No. 4 Buckwheat with a maximum of 20 percent through $\frac{3}{64}$ in. mesh and with a limit on the ash

* Chief Electrical Engineer and Mechanical Engineer respectively.

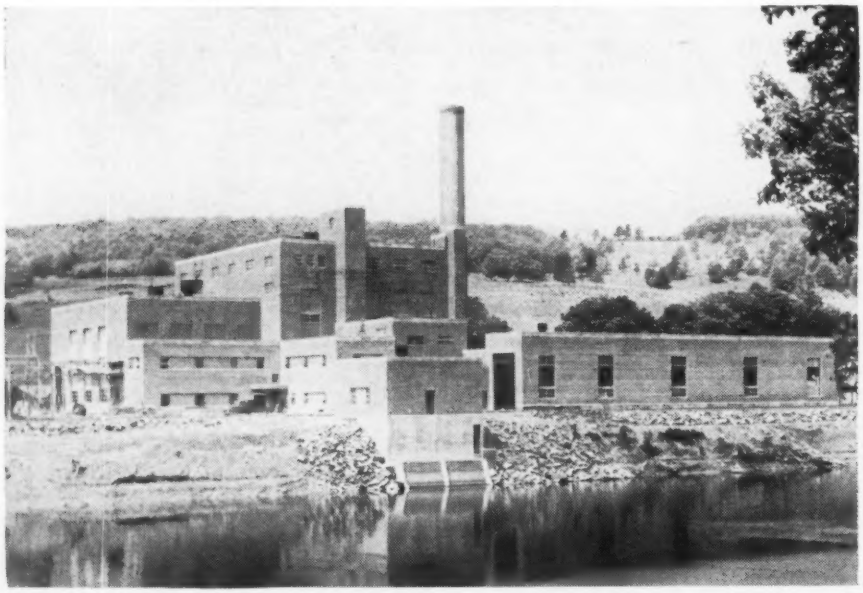


FIG. 1—Jennison Station of New York State Electric & Gas Corp. at Bainbridge starts with one 30,000 kva. unit operating at 650 psig. and 825 F.

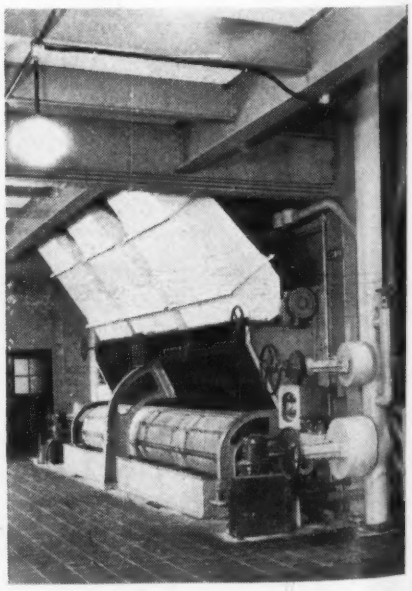


FIG. 2—Stoker burns small anthracite under 200,000 lb. per hr. boiler

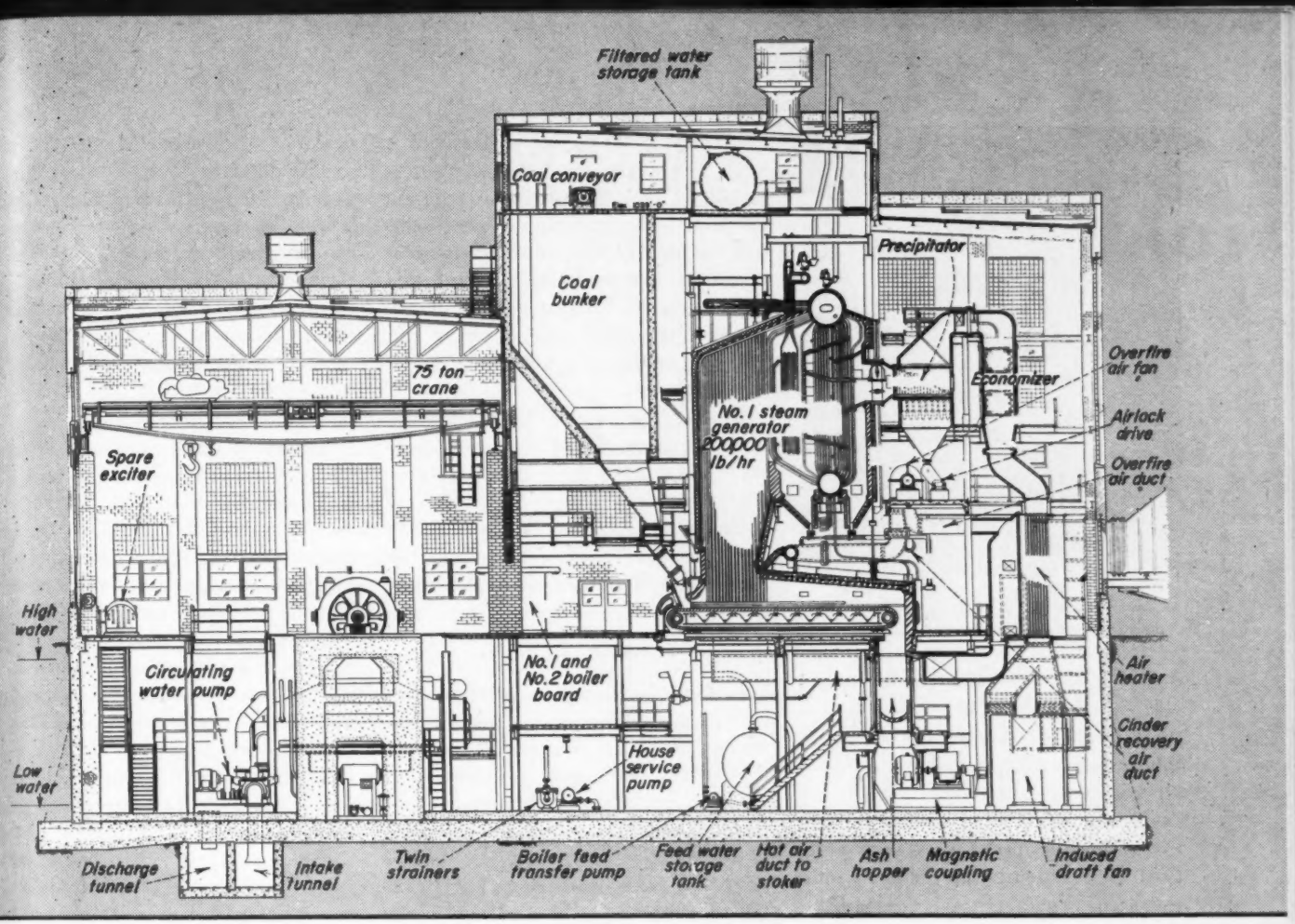


FIG. 3—Two 2-drum boilers deliver 650 psig. steam at 825 degrees F. to the 30,000-kva. unit

content. Other sizes of anthracite, even culm, may be purchased in the future. Furnace and ash pit have been designed so that underfeed stokers for bituminous coal may be installed at a later date should it become economical to change.

Coal is delivered to a four car track hopper house where it is dumped in a hopper with capacity for the entire contents of a seventy-ton car. Reciprocating feeders convey the coal to the No. 1 belt conveyor. The No. 1 conveyor and the storage reclaim hopper both feed onto the No. 2 belt conveyor where the coal is weighed on a Merrick Weightometer. The coal is thence discharged into a chain and bucket elevator which raises the coal to the No. 3 belt conveyor. At the top of the elevator the coal can also be diverted to the storage chute. The No. 3 belt carries the coal to the bunker screw conveyors which discharge into two 350-ton bunkers.

Bunkers and Stokers

Considerable study was given to the bunker design and a working model was constructed and tested with various fuels and moisture content before final design was approved. Limitation orders on steel plate necessitated a reinforced concrete structure. The bunkers have straight sides for approximately two-thirds of the depth, then one sloping side, lined with tile on a 50 deg. angle. The coal then flows to the stoker hoppers through inclined steel chutes, lined with stainless steel.

Combustion Engineering Co., Lloyd traveling grate stokers were selected. With the exception of a single unit of similar size, these are reputed to be the largest stokers of this design ever built, measuring 24 ft. wide by 28 ft. long. The grates are built up of many thin keys, dovetailed to the grate bars that are moved over wearing strips by forged steel chains.

Preheated air at 280 deg. F. is supplied by a Sturtevant vane-control forced draft fan and flow is regulated to various sections of the grate by means of separate zones with individual dampers. At maximum station output, each stoker will consume coal at the rate of approximately 17,500 lb. per hr. or 26 lb. per hr. per sq. ft. of grate surface. The individual stoker is capable of burning up to 24,000 lb. per hr.

Efflux Reburned

In the burning of fine grades of anthracite, it is expected that a certain quantity of unburned or partially burned particles will be carried in suspension by the flue gases and unless provision is made for collection, this would constitute a nuisance as well as cause severe abrasion at the economizer and preheater sections of the steam generators. To overcome this condition, collecting hoppers have been provided at the bottom of the first and last boiler passes. Gases leaving the boiler proper and before entering the economizer pass through a Western Precipitator of the multicyclone type, where most of the remaining cinder and carbon are collected. Due to the relatively high percentage of carbon present, it is economical to reburn this material. This is accomplished by means of cinder nozzles located at the rear of the furnace and provided with combustion air by a separate blower that takes the air from the preheater air

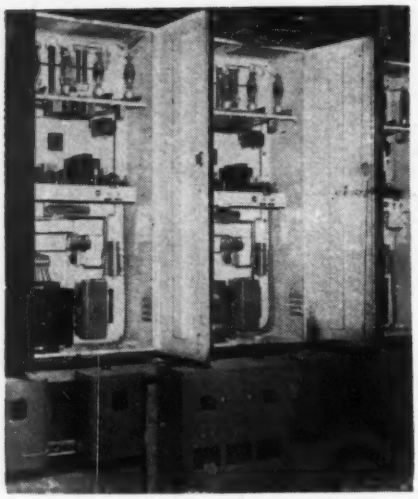


FIG. 4—Electronic control cabinets for magnetic couplings on I. D. fan drives

duct; the cinder collector is located between boiler and economizer. Anthracite cinder is very abrasive and this arrangement protects economizer, air heater and I.D. fan. This novel design is expected to aid materially in making the use of anthracite practical by reducing maintenance and extending the periods between shutdowns.

Ash is continuously discharged over the end of the grate to a conventional water-quenched ash hopper and pumped to fill periodically as required.

Steam Generators

Each of the two Combustion Engineering Co.'s two drum steam generators has a capacity of 200,000 lb. of steam per hour and will operate to deliver steam to the turbine throttle at 650 psig. with the steam temperature at 825 deg. F. from 120,000 to 200,000 lb. per hr. output. Steam temperature will be maintained by means of two bypass dampers at boiler output, so arranged as to bypass gases around the superheater but only bypassing a minimum amount of boiler surface.

The furnace is water-cooled on all sides. Front and rear walls are bare tube construction while side walls are finned tube. A suspended refractory ignition arch is provided over the rear section of the stoker.

A continuous loop economizer and tubular air preheater complete the unit.

Induced draft fans are a large slow-speed paddle-wheel type, furnished by B. F. Sturtevant Co. Scroll cases are fitted with removable liners. Fan speed may be varied through a wide range by magnetic couplings supplied by the Electro-Dynamic Corp. Although variable speed control of fans is the most economical of power, the main purpose of this choice was to provide for minimum impeller tip speeds at all boiler ratings and in this way keep fan erosion at a minimum.

Boilers are provided with a complete set of fixed, rotating soot blowers. In addition there are retractable soot blowers installed at the top of each furnace to keep the entrance to the first pass clear. These are remote controlled from the boiler control board.

Combustion Control

Leeds & Northrup combustion control was selected for this installation. Essentially this equipment controls the stoker and induced draft fan speeds to maintain steam pressure and the fuel-air ratio. The furnace draft is regulated by varying the forced draft fan vane positions. The steam temperature is controlled automatically by bypass damper positioners in response to a temperature element in the superheater outlet of each unit. There is also remote manual control of the over-fire air.

A complete set of draft and pressure gauges is installed at the boiler board to serve as a guide to the operators. Pressure gauges are also installed convenient to the stoker to indicate compartment air pressures.

Temperature and flow recorders are also installed to give complete information on boiler and turbine performance. An interesting feature is the installation of the pump room gauges in the pump control cubicle.

Regenerative Cycle

The main generating unit is a single cylinder, General Electric, 18-stage impulse condensing turbine directly connected to a 30,000 kw. hydrogen-cooled generator. At full load the steam flow to this machine will be about 320,000 lb. per hr.

The plant cycle is four-stage regenerative and extraction for feed heating is taken from the 8th, 11th, 14th and 16th stages. The cycle is as follows: Condensate from the main condenser hot well is pumped through the ejector inter- and after-condensers, then through the low pressure heater to the deaerator, heat being added from the 16th and 14th turbine stages respectively. The pressure in the deaerator will vary with load as the 14th stage pressure varies. Ingersoll-Rand six-stage opposed impeller, centrifugal pumps with 400 hp. motors are provided to pump the condensate plus make-up through two high pressure heaters where heat is added from the 11th and 8th stages. A feed water

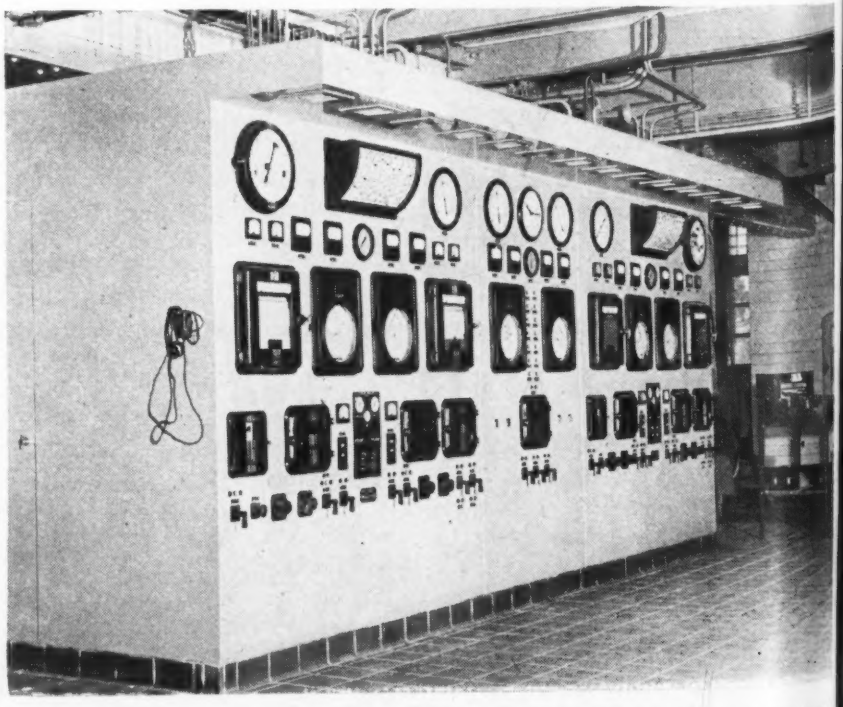


FIG. 5—Boiler room control board for manual and automatic operation of the two steam generators

recirculating line from the boiler feed pumps to the deaerator is provided. An evaporator floating on the 11th stage supplied with treated evaporator feed supplies an estimated one percent make-up as vapor to the deaerating heater.

Condensation

The main condenser, manufactured by Ingersoll-Rand, contains 23,000 sq. ft. of effective surface made up of $\frac{7}{8}$ in. O.D. No. 18 BWG Admiralty tubes, 24 ft. long. It is of two-pass design with divided water box. Two 24-in. reversing valves are provided to permit reversal of circulating water flow for back-washing.

The condenser is rigidly connected to the turbine exhaust flange and partially supported on springs.

Two Ingersoll-Rand four-stage vertical condensate pumps each having a capacity of 540 gpm., 1750 rpm. direct connected to a 50-hp., 440-volt, 3-phase, 60-cycle and two Ingersoll-Rand 11,325-gpm., 575-rpm. single stage circulating pumps direct connected to 125-hp., 2,300-volt motors complete the unit.

Shallow wells provide a primary source of make-up water which is pumped to Graver carbonaceous cation-exchange, brine-regenerated softeners. The softened effluent goes to the evaporator deaerator and then to the evaporator as required.

The secondary source of make-up water is the Susquehanna River. The water is fed into the mixing and flocculating tank through a float operated control valve, and alum and soda ash added and mixed by a variable speed flocculator reel. The treated water is retained in a settling tank for a minimum period of four hours, whence it passes to the softeners or storage through filters.

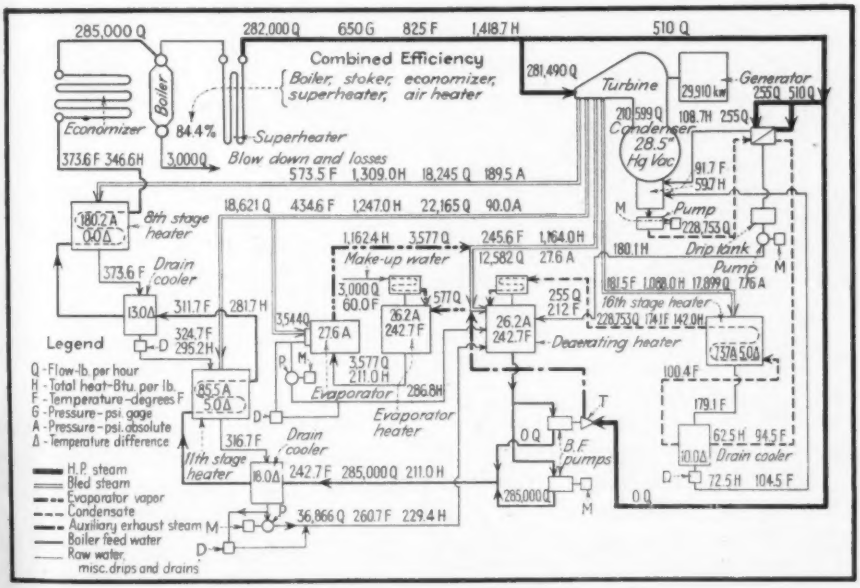


FIG. 6—Heat balance diagram for 30-mw. load shows 11,998 Btu. gross at 100 percent RE. At 7½-mw. load it is 13,723 and for 10 percent overload 12,226

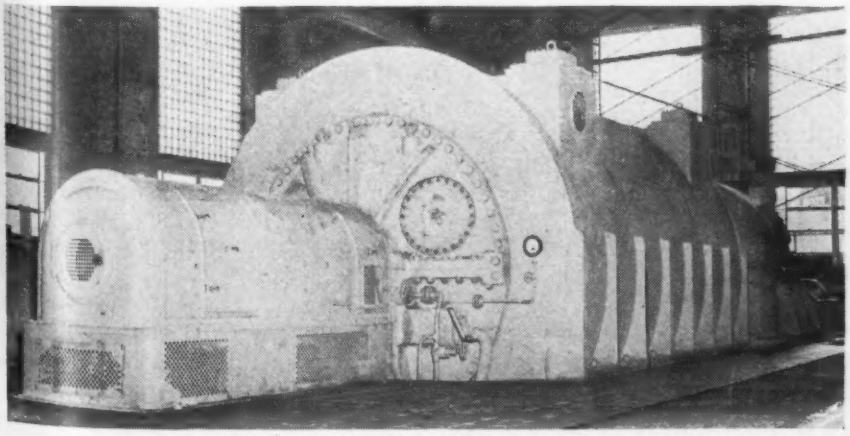


FIG. 7—18-stage turbine drives hydrogen-cooled generator with shaft exciter

Equipment is installed at the travelling screen house to apply chlorine treatment periodically to inhibit fouling of the condenser with organic matter. A feature of the screen house is a tunnel passage to the main building.

Output to Transmission

The 30,000-kw. generator is connected to three 10,000 kva. self-cooled, 13,333 kva. forced-air-cooled, 3-winding General Electric Co. transformers, stepping up generator voltage of 13.8 kv. to 46 and 114 kv. About half the output of the plant will supply the load on the 46-kv. transmission system, and the other half will feed into the 114-kv. system.

The plant was designed and construction supervised by Gilbert Associates, Inc., Reading, Pa. The main contractor was George A. Fuller Co., New York City.

Smoke Abatement Ordinance

A solution of the problem of smoke abatement designed to give a community the cleanest air which it can afford was presented at the current A.S.M.E. convention in the form of a proposed smoke regulations ordinance.

Embraced are the creation of a department of smoke regulation headed by a salaried chief smoke regulation engineer who would be assisted in enforcement by an advisory board, most of whom would be engineers, and an appeals board.

Provision is made for approval of new fuel-burning installations as properly engineered, for annual inspection of equipment to insure proper maintenance from the smoke-abatement angle; strict regulations on allowable smoke emission, both as to density and length of time, are detailed. The Ringelmann Chart as published by the U. S. Bureau of Mines is made the criterion for smoke density.

Fuel and equipment dealers also would be brought within the scope of the ordinance, fuel dealers being required to specify volatility of the fuel sales and dealers being required to report equipment sales in order to facilitate inspection and enforcement.

Pole Replacement Study Shows Post-War Requirements

Past life experience is applied to 203,665 poles to estimate replacement requirements for 5-yr. periods to 1967—Mortality curve results as byproduct of study

F. B. DOOLITTLE, Electrical Engineer, Southern California Edison Co., Los Angeles, Calif.

IN ORDER TO DETERMINE the magnitude of deferred maintenance insofar as it applies to wood poles, a study was made by Southern California Edison Co. to estimate year by year post-war pole requirements for replacement purposes. Inasmuch as the pole plant was not added to the system at a constant rate, it was realized that pole replacements because of deterioration would run in cycles related to periods of rapid growth. For this reason it is not possible to estimate future pole requirements based upon a straight-line projection of past replacements.

The study applied to 467,490 poles which were more than 15 years old as of December 31, 1942. Of this number, 263,825 had become mortalities from all causes prior to December 31, 1942. The object was to estimate when it would be necessary to replace the 203,665 poles which remained in service on December 31, 1942. The poles were mostly western red cedar and were butt treated by the open tank method.

Method of Approach

The known facts were:

1. Number of poles acquired in various periods in the past.

2. Numbers and ages of the poles remaining in service on December 31, 1942.

Fact No. 1 was obtainable from purchase and stores records. Fact No. 2 was obtained from pole card records. These records consist of a card for each pole in service showing, among other things, the date the pole was set. The method of analysis was as shown in Fig. 1.

Neglecting poles which were less than 15 years old as of December 31, 1942, the top line on the graph shows the total number of poles acquired in each 5-yr. period. The next lower heavy line shows the number of these poles which remained in service as of December 31, 1942, expressed in percent of the original number of poles acquired in each period. It will be noted that, in the 15-20-yr. age group, 78.3 percent of the poles originally acquired were still in service as of December 31, 1942, while in the 20-25-yr. age group only 51.9 percent remained in service. Therefore, it was assumed that in five more years only 51.9 percent of the poles in the 15-20-yr. age group should remain in service if past mortality experience applied to the future. On this basis, the difference between 78.3 percent and 51.9 percent, or 26.4 percent of the 180,450 poles originally in the 15-20-age group should be replaced in the 5-yr. period, 1943-1947. The same reasoning was applied to the other age groups and time was advanced in additional 5-yr. increments to obtain the results tabulated under "legend" in Fig. 1.

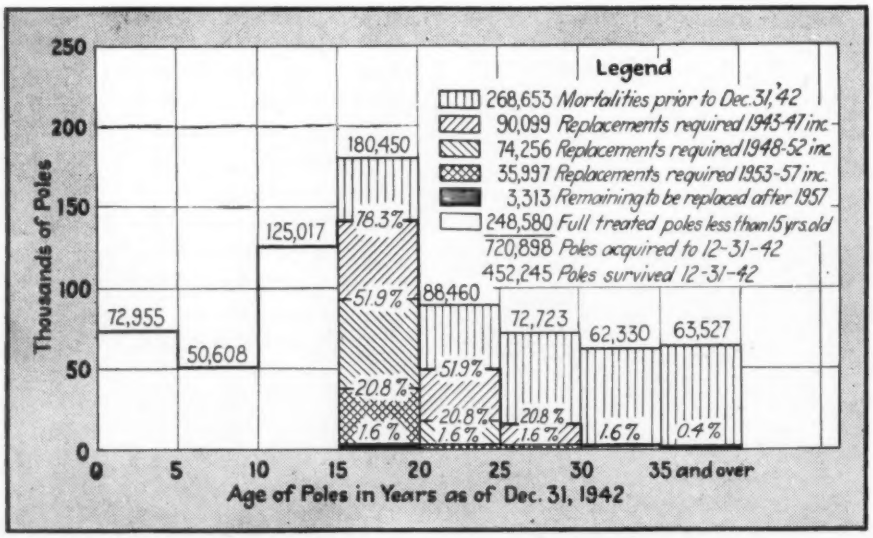


FIG. 1—Pole replacement requirements for 5-yr. periods as determined by pole replacement study

Heavy line indicates poles in each group remaining in service as of December 31, 1942. Percentages are those of the original poles in each group which survive as of the ends of the periods. Poles in the age groups, from 0 to 15 yr. old, are treated full length and over 98 percent of all acquired survived as of December 31, 1942

Mortality Curve

An interesting byproduct of this study was the mortality curve shown in Fig. 2. This was obtained by plotting, as ordinates, the percent mortalities prior to December 31, 1942, obtained from Fig. 1 and, using as abscissae, the midpoints of each of the 5-yr. age groups. This mortality curve is not strictly a physical life curve for the poles in question because it includes, as mortalities, some poles

which were removed from their original locations and later reset in other locations and also poles destroyed by fires, storms, collisions, etc., but the proportion of such poles was not large. Of the poles that were mortalities because of physical deterioration, it is probable that damage to the untreated tops by dry wood termites peculiar to this region accounted for more replacements than were occasioned by either decay or termite attack in the treated butts.

The principal reason for the indicated necessity of an accelerated pole replacement program at this time is found in the rates at which poles were installed in the past. These rates by 5-yr. periods are as shown in the following table:

Period	Present Age in Years	Number of Poles Acquired	
		Total for Period	Average per Year
Prior	Over 35	63,527	
1908–12 Incl.	30–35	62,330	12,466
1913–17 Incl.	25–30	72,723	14,545
1918–22 Incl.	20–25	88,460	17,692
1923–27 Incl.	15–20	180,450	36,090
1928–32 Incl.	10–15	139,669	27,934
1933–37 Incl.	5–10	46,393	9,279
1938–42 Incl.	0–5	67,346	13,469

Of the 180,450 poles installed in the 1923-27 period, 141,378 were still in service as of December 31, 1942. Referring to Fig. 2, it will be observed that these 141,378 poles are currently progressing from an average age of 17.5 years, during which 21.7 percent of the original 180,450 poles were mortalities, into a life period of 17.5 to 35 years, during which practically all of the remainder or 78.3 percent may be expected to become mortalities. Thus, the present situation is that the poles installed during the fastest growing period in the company's history have reached the age when high mortality rates will apply to them.

Again referring to Fig. 2, there is shown between 0 and 8.7 years, the start of a mortality curve based on the 253,408 full-length treated poles installed in the period, 1928-1942 inclusive. The trend of this curve beyond the present weighted average age of 8.7 years will depend on future experience with full-length treated poles, but the fact that mortality in 15 years was obviously so much lower than experienced with butt-treated poles indicates that at least a respite may be expected in the required rate of pole replacements after about 10 years. This indicated respite may prove most opportune because for the duration of the emergency it may be impossible to replace poles at the rate which this study indicates will be required to prevent additional physical plant depreciation and the respite may afford the opportunity to catch up. The two years that have elapsed since this study was made have proved the soundness of this conclusion.

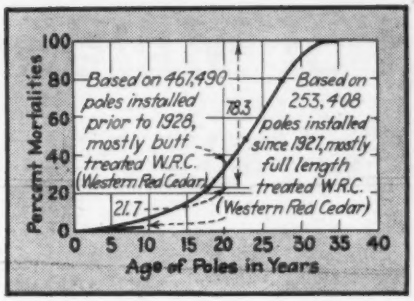

Percent Mortalities
100
80
60
40
20
0
Based on 467,490 poles installed prior to 1928, mostly butt treated W.R.C. (Western Red Cedar)
78.3
21.7
Based on 253,408 poles installed since 1927, mostly full length treated W.R.C. (Western Red Cedar)
0 5 10 15 20 25 30 35 40
Age of Poles in Years

FIG. 2—Pole mortality curve developed from pole replacement study

The study proved well worth the time and effort required and the method of approach and results are now presented for the benefit of other power companies that may be interested in making a similar research on pole replacement.

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Power Train Is Sealed for Export Shipment

By GRAHAM LEE MOSES

Transportation and Generator Engineering, Westinghouse Electric Corp., East Pittsburgh, Pa.

A project for improved protection of electrical machinery and exposed metal surfaces during sea shipment has resulted in individual rail cars of mobile central generating stations or power trains being arranged as hermetically sealed unit packages for deck load. As the prime objective of the train is quickly to produce power upon arrival at its destination most of the apparatus is assembled in place in each car. Precautions for entrance of rain, sea spray and deck wash, also for condensation of atmospheric humidity within, are accomplished by sealing each car with a giant moisture vapor barrier and dehydrating the internal moisture with a desiccant.

That the program was feasible both from engineering and manufacturing angles was demonstrated by the test of one of the sealed cars—the Service Car which contained machine shop, laboratory and crew quarters, plus several thousand pounds of wood "dunnage" containing moisture.

All openings of the car were covered with steel plates or flashed with waterproof cloth. Cracks and joints were caulked. The whole car was then sprayed with a coat ($\frac{1}{16}$-in. minimum thickness) of nonbreathing waterproof compound. Immediately before final sealing of the door, 1,200 lb. of silica gel (in 5-lb. bags) was distributed throughout the car.

The car was under test continuously for 216 hours. In order to insure wide temperature cycling and exposure to high humidity the car was moved from indoors to outdoors several times and sprayed with a fire hose. The weather cooperated by providing temperatures as low as 16 deg. F., a rainstorm and a 6-in. snowfall.

Highest and lowest temperatures observed were 59 and 37 deg. F. for inside the car, 74 and 16 deg. F. for outside the car. Relative humidity range was 30 to 16 percent for inside the car and 100 to 29 percent for outside the car. Relative humidity decreased rapidly inside the car from 30 percent at start to 20 percent in 4 hours and 16 percent at the end of 28 hours. Analysis of the silica gel moisture content indicated that equilibrium had been reached at 16 percent relative humidity.

The non-breathing, waterproof material used for sealing the cars is a compound having a petroleum asphalt base with the addition of a considerable percentage of gilsonite asphalt and an inorganic filler (mica dust). It is used as a solution, applied by spray equipment, dries slowly by solvent evaporation but retains its plastic moisture vapor seal characteristics over a temperature range from minus 50 deg. C. to plus 50 deg. C. Silica gel was used because it is the most inert of the desiccants and can be placed on the surface of parts to be protected without danger.

A conclusion indicates possibilities for improved protection for large equipment which hitherto has been either left to mercy of the elements or at best meagerly protected. A considerable number of these trains have been processed in this manner.

Shop Testing of Meters Examined in Symposium

Experience of several New England utilities brings out many advantages, provided each case is thoroughly studied prior to reaching a decision—Modern test equipment advocated—Effects of transportation of meters—Geographic basis for changing meters for test

AT A RECENT MEETING of the New England Association of Meter Engineers the following symposium on shop testing experience was presented by R. J. Griffen of the Lawrence (Mass.) Gas & Electric Co., based upon the work of that utility and of the Salem (Mass.) Electric Lighting Co., C. C. Estes, department head, and Lynn Gas & Electric Co., under Benjamin Sprague. The question and answer method was adopted to emphasize the essential points brought out, and is presented below in that form.

Types of Meters

1. *Q. In adopting a shop testing program should all meters be removed to the shop for test?*

A. It has been our experience that shop testing can be applied to the majority of residential type meters on utility lines. Two-element type "S" meters can be readily changed and returned to the shop for test. Where a large group of meters is grouped in one location like an office building or apartment house, it may be more economical to test them "in place," carefully weighing the relative economies of shop and field tests. Some field testing is necessary, especially on transformer type meters, self-contained polyphase meters and network type meters on the three-phase, 4-wire system. Field testing is necessary in special installations and in connection with complaints. Demand meters of the mechanical register or thermal type should be shop-tested.

At Lawrence, in general, only single-phase, self-contained meters and demand meters of the mechanical register type are removed to the shop for testing at present. We feel that due to the possibility of phase reversal with resulting change in phase rotation it is better to test all polyphase meters in the field. However, in case of two-element network type "S" meters shop testing will probably be adopted in the future. At Lynn it is the practice at present to remove the smaller sized polyphase meters for shop test.

2. *Q. How accurately should we expect to adjust the meters?*

A. Meters should, of course, be adjusted to as near 100 percent accuracy as is possible consistent with the testing equipment available and the test cost. In field testing the accuracy of test and calibration depends to a large degree upon the skill, experience and judgment of the test man. In shop testing where automatic equipment can be used, the human error is largely eliminated and results within 0.3 percent can reasonably be expected. Shop testing is ideal for better calibration. Besides being made under cleaner conditions, a more even temperature is maintained in shop testing, the mean temperature being about 70 deg. F. Temperatures vary widely in the field, and it is felt that with the older meters, which are not compensated, shop tests are better. A reference to the average temperature curves of watthour meters from various manufacturers and a number of papers and articles which have been published on this topic will prove very interesting. The effect of temperature changes on the watthour meter standard should not be overlooked. In the shop it is possible to make power-factor tests and adjustments on single-phase meters which cannot be done in most field cases.

Effects of Transportation

3. *Q. If we remove the meters for test to the shop, what effect, if any, will transportation have on the meters?*

A. Experience has shown that if the meters are carefully handled, transportation will have little effect on their calibration. With automatic shop testing equipment it is possible to test and calibrate meters much more accurately than is possible in the field, which should tend to offset any possible error introduced through transportation. The Lawrence company recently made some tests in relation to the effect of transportation on meters. Several single-phase house type meters of different makes were transported for two and three days respectively in a horizontal position, and then for two days in a vertical position with disc and shaft riding on meter bearing in a meter truck. Tests were made before being placed and after removal from the truck. The mileage ran from 40 to 63, and it was found that little effect was felt by distance traveled. In 12 tests 50 percent of the meters showed no change at full load, unity power-factor; no changes were noted at light load on unity power-factor; and 8.3 percent showed a change at full load, 50 percent power-factor. In 41.7 percent of the full load, unity power-factor tests the change was between 0.1 and 0.4 percent inclusive.

This was the case in 50 percent of the light load unity power-factor tests, and in 91.7 percent of the full load 50 percent power-factor tests. In 8.3 percent of the full-load unity power-factor tests the change was between 0.5 and 0.8 percent, and this was true with 50 percent of the light load unity power-factor tests.

Full load adjustment is unappreciably affected by transport. As these tests were not made on automatic equipment some personal error of the tester probably entered into the results. Apparently it makes little difference whether a meter is carried horizontally or vertically, although the horizontal position involves less possibility of damage to the meter jewels. Later tests on four more meters transported horizontally for 4 days and 87 miles and made by photoelectric testing equipment bore out the previous conclusions. Here no change occurred in accuracy between 0.5 and 0.8 percent at full load, unity power-factor, while one meter changed between 0.5 and 0.8 percent at light load, unity power-factor and another at full load, 50 percent power-factor changed between 0.5 and 0.8 percent.

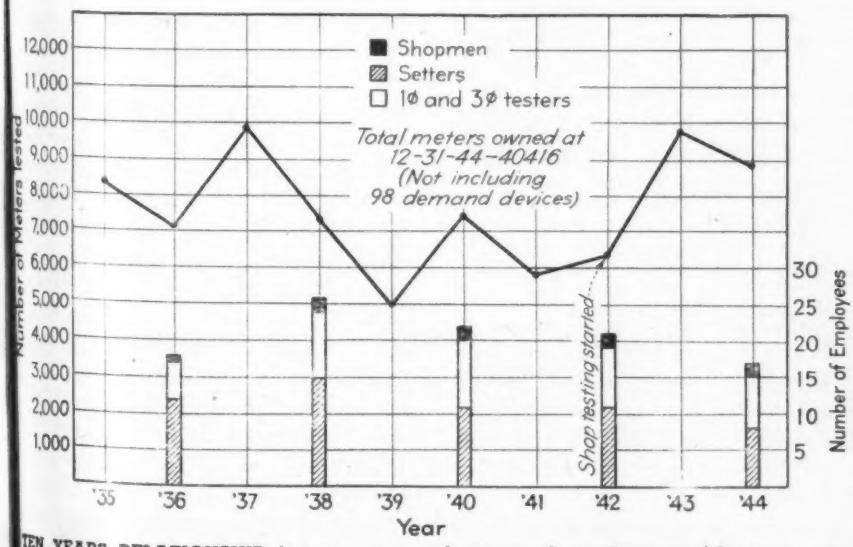
Test Interval

4. *Q. How often should meters be tested?*

A. The length of time between tests will in some cases be determined by state commissions. Association of Edison Illuminating Companies' meter committee studies point to 8-year and even longer test periods. A 12-year test schedule may not be too long with modern meters having Alnico magnets and improved bearings. Very casual studies of meter accuracies against length of time in service have been made which indicates this possibility. However, with the older type meters, most companies have and will probably continue in use for many years a 7-year test schedule as a safe minimum. It is felt that after meters have been through the shop once they will move through much more rapidly a second time, as less maintenance will be necessary. The cost of handling the meter will therefore be considerably less on subsequent trips through the shop.

5. *Q. Can existing personnel be used more efficiently in shop testing?*

A. Experience has shown that very efficient use of personnel is possible through shop testing. Installers can change meters in the field, thus making it possible to use meter testers in the shop and on polyphase meters, etc., in the field. In every meter department, fill-in jobs are necessary to take up the slack due to variation in the volume of regular work. Changing meters for test provides a ready means for doing this and helps out in the testing program. In determining the personnel necessary for test and repair operations, one should base operations on the present personnel available and any filling in assistance by other men. Assistance by post-war personnel should also be considered. The accompanying curves show the number of meters tested by the Lawrence company from 1935 to 1944 inclusive, and the number of meter setters, meter testers and shopmen in he meter department.



TEN YEARS RELATIONSHIP between test and personnel requirements (shopmen, setters and testers) on system of Lawrence Gas & Electric Co.

Repair and Overhaul

6. *Q. Should we attempt to repair or overhaul the meter at the time of test?*

A. By all means yes, as we still expect the meter in most cases to operate for a 6 or 7-year period before being again tested. This is true only if a company is regularly testing meters every six or seven years. If a company is able to test about half its meters, the length of time between tests may run from 12 to 14 years. Only by returning the meter to the shop can we expect to do a thorough repair job. A meter in the shop can be given a high-potential insulation test, the register and other parts completely overhauled and cleaned, and the meter fully overhauled and painted, all under ideal conditions and at a minimum cost.

7. *Q. What equipment will be necessary for shop testing?*

A. For smaller companies, modern testing equipment with new or remodeled test boards using either stroboscopic or photoelectric apparatus should be considered. In the larger companies, automatic gang testing or other test means may be desirable. Lawrence uses two boards equipped with photoelectric facilities. Salem is using gang test boards at present but contemplates purchasing automatic testing equipment. Lynn is using a single position photoelectric tester and also a single position non-automatic test board.

High-potential insulation test equipment should be provided. Equipment for cleaning parts should be considered on the basis of one set to about 40 to 50 meters handled through the shop per day. For efficient operation, clean testing quarters, ample working space and proper equipment arrangement are essential. Sequence of test and repair operations should be carefully worked out to insure a smooth flow of meters through the shop. Good lighting and good housekeeping should be the case, as these greatly affect employee morale. A modern meter shop kept in spic and span shape also serves notice on visitors that a superior quality of work is here performed. The cost of proper equipment and good housekeeping can be more than offset by

the quality and quantity of work done, and a careful study of meter testing costs will bear this out. Experience has shown that it is necessary to maintain a substantial meter stock to have enough meters on hand to take advantage of any personnel that may be available for changing meters during slack periods.

Meter Trucks

8. *Q. Can present transportation facilities be used for carrying meters to and from the shop in large numbers?*

A. Experience has shown that in general present transportation facilities are suitable and can be used. The type of truck body to be used will depend on local conditions and preferences. However, in selecting the type of truck body when new trucks are again available, the arrangement of the compartments for meters, tools and supplies should be carefully worked out. This will insure utilization of all available space and eliminate lost motion in locating supplies on the truck.

9. *Q. Can costs be reduced through shop testing?*

A. Through the use of modern meter testing equipment the number of tests per day can be materially increased without adding to the tester's fatigue. In field testing the overall average number of tests per man per day on single-phase residential meters runs between 10 and 11 meters. With proper test equipment in the shop and careful routing of the meters, the number of tests on old meters may run as high as 40 or better per man per day. Another important factor in reducing testing costs is the elimination of test slips when meters are shop-tested. The tester can verify the meter data on the history card, thus reducing paper work to the minimum. From a legal standpoint the record made by the tester himself is the original record and the only record recognized in court proceedings. An analysis of the cost of modern meter shop equipment shows that adequate equipment can be purchased at very low annual charges.

Changing and Clerical Work

10. *Q. What method should be used in changing meters for test?*

A. Experience shows that the geographic basis is best, as the meter reading routes can be followed. This works well in combination gas and electric companies, as both gas and electric meters can be changed at the same time. In the Lawrence and other companies of the New England Power Association system a decalcomania showing the year, such as the figure "45," is used on electric meters to indicate readily the latest test date. The figures are about ½ in. high and are black on a yellow background.

11. *Q. Does changing meters for test materially affect clerical work in meter, accounting and billing departments?*

A. In general, the increased orders which result in removing meters to the shop for test can be handled by the existing clerical force through machine billing and the Kardex system for customer and meter records. At Lawrence the introduction of a rotating meter history and card record file in the meter department has helped materially in absorbing the additional clerical force which would otherwise be required. Furthermore, the clerical procedure for changing gas meters has been completely established in gas and combination companies, and hence the changing of electric meters for shop test cannot present any serious problem.

12. *Q. What is the reaction of the customer and the various commissions in regard to removing meters for shop test?*

A. There is no record of any customer objecting to our changing meters for test or raising any question because of the shop test. In New England, Vermont, New Hampshire, Massachusetts and Rhode Island have no ruling on this subject. In Connecticut the commission ruling is that all tests of meters in service shall be made in the place of permanent location on the customers' premises with approved testing apparatus.

Conclusions

Shop testing of meters has many advantages. The physical set-up in each company is such that the decision as to the testing method should be made only after careful study. In this symposium no attempt was made to go into testing costs. Accounting practices and wage scales vary so widely that an extensive study would be necessary to arrive at comparable cost data. Nor does a comparison of unit costs through the years in any one company give a true picture, as changes in the wage scale from time to time make this difficult. Trying the shop testing method even on a small scale is one way to determine whether it fits the needs of a particular utility.

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Arc-Furnace Protection

Protection against both sustained overcurrents and short-circuits is obtained in a British arc furnace installation by resort to relays in two stages. In the Reyrolle Scheme described in a recent issue of *Electrical Review*, unnecessary breaker operation on overcurrents is avoided at the same time as affording coordination with the overcurrent relays of the supply system. The latter often operated before the electrodes could be withdrawn far enough to restore the refining current to normal.

Stage one, the "small overcurrent" function, consists of an overcurrent relay with inverse and definite-minimum time-lag characteristics. It has a plug-setting range of 50 to 200 percent with variable time-lag settings longer than those of a standard relay. The short-circuit stage has a plug-setting range of 100 to 400 percent with standard variable time-lag settings. The two together have a time-current characteristic with long time-lags at small overcurrents up to 3½ to 4 times full load after which the time-lags are relatively short. It is necessary only to coordinate the second stage with the back-up relays on the power system.

Sometimes an overcurrent relay can be connected to the current transformers on the low-voltage side of the furnace transformers. The stage-one overcurrent relay is then connected to these current transformers and the stage-two relay to those on the high-voltage side. This arrangement gives improved over-current protection because the thermal rating of the transformer is generally fixed by the secondary winding; since the ratio of the transformer varies with different tap-change positions it follows that the primary current is not always a measure of secondary current and thermal loading on secondary side.

Interlocking is provided so that the operator can change taps only when the circuit breaker is open.

Switchyard Lighting Speeds Rail Traffic

Denver and Rio Grande installs high-tower floodlighting in five yards—Cars located and trains made up faster and more safely

L. RAGLE, Purchasing Agent, So. Colorado Power Co., Pueblo, Colo.

NIGHT OPERATIONS at Pueblo and Grand Junction, Colo., as well as several other key yards on the Denver and Rio Grande Western Railroad, have been speeded up by the installation of a number of 110-ft. steel floodlighting towers spotted strategically in each yard. The railroad has found these installations to be of great value in increasing efficiency and reducing accidents.

At Pueblo, eight such towers have been erected, each mounting one or more floodlights of 1500 watts with narrow beams for long and medium throws and 500-watt side-beam units for short throws for lighting near the towers.

In addition to the towers at Pueblo the railroad has installed nine towers at Roper, Utah, (Salt Lake City), seven at Grand Junction, Colo., seven at Helper, Utah, and four at Minturn, Colo., making a total of thirty-five.

The towers were supplied by the American Bridge Co., using galvanized steel angle construction. They are designed to resist a wind pressure of 30 lb. per sq. ft. of exposed area.

The electric supply to the towers at each yard is a 2400-volt, single-phase circuit, except at Helper where the circuit is 6600 volts. General Electric Novalux photo-electric relays switch the lights on and off by control of oil breakers in the primary circuits. Transformers of 15 or 25 kva. are mounted on platforms at the tops of the towers and are energized through 2-conductor No. 6 Okonite underground cables buried in the ground to the feet of the towers and supported on them in the vertical rise by split wood clamps. The transformers are protected on the primary side by fused cut-outs and the secondary 120/240-volt 3-wire services to the floodlights are controlled by fused raintight switches. Connection to each floodlight is made in a raintight junction box with porcelain fuse blocks through 2-conductor 10-strand tellurium portable power cable clamped to the steelwork.

EFFECTIVE railway yard lighting utilizes direct illumination, silhouette, and glint on rails. Note underslung transformer platform in tower picture, putting primary and secondary voltages on different levels

The towers are grounded at two diagonally opposite corners by galvanized steel ground rods connected to the towers by $\frac{5}{16}$-in. stranded guy wire.

According to A. E. Perlman, chief engineer for the Rio Grande, the yards are taxed to capacity by the consistently heavy freight movement. Materials and sufficient labor are not available to construct new facilities. It has been imperative to keep all yards "fluid." To accomplish this, freight cars cannot be allowed to accumulate during the night. The floodlight installations were designed to enable the railroad workmen to locate cars more readily, to read bills attached to the cars, and to make up trains more swiftly and get them rolling over the rails.

Since their installation the new floodlights have proved extremely valuable in reducing accidents. A high percentage of employee injuries are sustained in yard accidents, particularly at night. The new lights enable switchmen to see rails and frogs, and approaching freight cars. The lights have also reduced pilfering and opportunity for sabotage.

Preparing and Repainting Outdoor Electrical Equipment—II*

Weather problems in painting discussed with use of instrumentation to control program in field—Applicability of brush and spray methods —Use of forms and appearance ratings

E. B. CURDTS,† The Narragansett Electric Co., Providence, R. I.

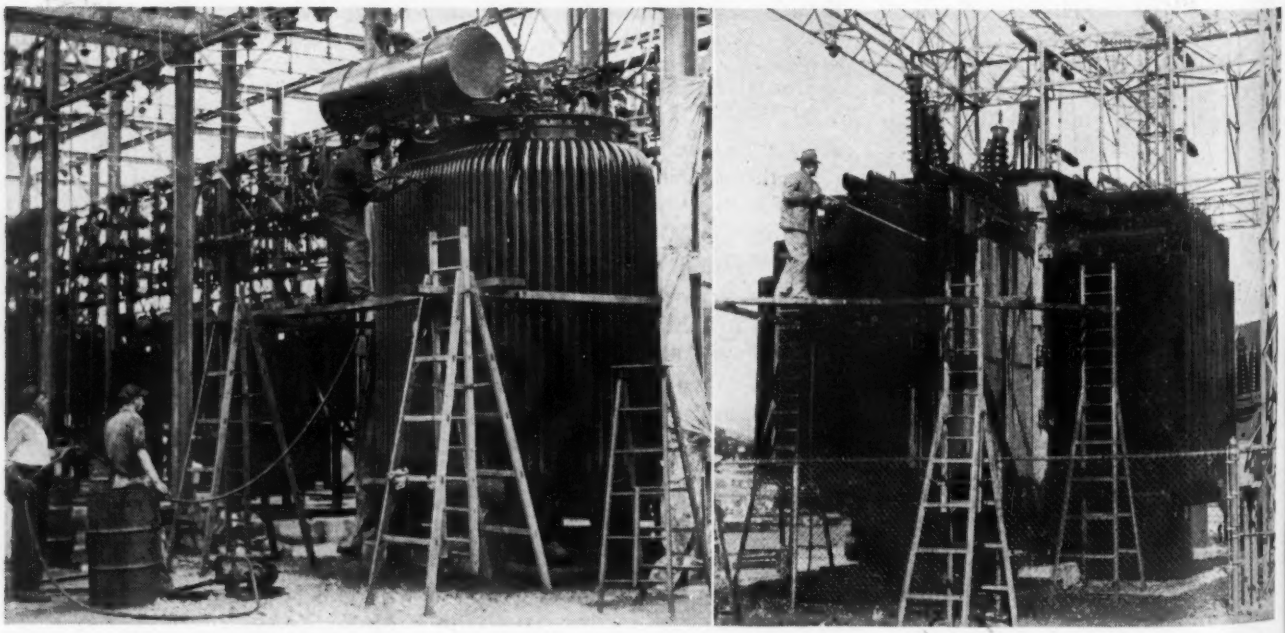
ANYTHING SAID about paint quality in this paper presupposes that certain ingredients for making high quality paints for metals are again available. Since surface preparation and labor of application constitute the largest part of total repainting cost of metal equipment, the maintenance engineer can well afford to pay a relatively high price for paint, provided long life, good color and gloss retention result. Paint salesmen's claims must be evaluated by accelerated life and other laboratory tests. Though these may be less conclusive than field tests in some cases, the time needed to make comparisons in the field may delay choice of the better materials. Any field comparisons, of course, must be made under identical conditions of surface preparation, application and exposure.

When galvanizing on the more vulnerable parts of steel-bus structures, and generally on metal, chain-link fences begins to fail and rust appears, it is sometimes uneconomical or impracticable to clean the defective areas thoroughly before painting. The paint chosen should survive a reasonable time over these areas and bond well to adjacent galvanized areas. We have found a formula of castor oil and fish oil pigmented with zinc dust and possibly zinc oxide well suited.

Today it is common practice in factory and field to paint outdoor electrical equipment with a synthetic resin enamel. The synthetic resins are either of the alkyd type (Glyptal) or the phenol formaldehyde type (Bakelite), and used as the vehicle for the pigments to replace the natural resins. These synthetic resins may be mixed with the drying oils or chemically combined with them to form oil-modified resins. The synthetic enamels are usually made quick-drying for field use, 6 to 12 hours, by introducing

* See first installment in ELECTRICAL WORLD, November 24, 1945.

†At the time this article was prepared, the author was Superintendent of Substations and Maintenance for The Narragansett Electric Co. He has since become Applications Engineer for the J. G. Biddle Co., Philadelphia, Pa.



FLOW COATING a 10,000-kva. transformer (left). Tubes of the unit being coated are four layers deep. Each coat was completed in 7 min. flowing time. (right) Flow painting a 40,000-kva. transformer. New black paint is being flowed over original gray finish coat applied at factory. This gray coating had almost completely chalked away in about four years. The radiators are so closely mounted together that it would be impossible to apply a complete coating of paint by any method other than flowing without removing some of the demountable radiators. A two- or three-man crew suffices for some equipments

driers in the form of metallic resinates. At the factory more and more use is being made of oven or infra-red heating for baking on synthetic enamel that is formulated by this treatment, which should add much to service life. Pigments in the priming coat may be of the zinc or lead chromate type with second and/or finish coats of synthetic enamels chosen for contrast and color. Undercoats should be of contrasting shades or colors to aid thorough coverage of all areas. For finish coats various shades of gray and green are most popular, although some maintenance engineers prefer aluminum. Black has the best color retention and stability, although in some opinions, even where its luster is held, its appearance is less pleasing than freshly applied greens or grays.

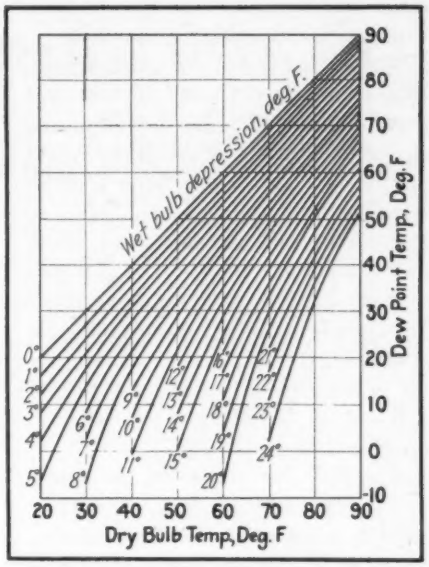


CHART of dew point, dry bulb and wet bulb temperature relations

Weather Problems in Painting

Fitting painting schedules to the weather is difficult in planning an efficient program for outdoor metal equipment and structures. Geographical location and season affect the work and must be considered both in its planning and progress.

Most paint manufacturers advise painting outdoor metal work in ambient temperatures above 50 deg. F., with relative humidities not above 65 percent. In cold or humid weather advantage may sometimes be taken of the higher than ambient temperature of certain equipment like transformers and regulators that have just been removed from service or which remain in service during painting. That is, if the temperature of the coldest part of the equipment is higher than the dew point, manufacturers' limits can be ignored. However, water can be absorbed from air below 100 percent humidity by many corrosion products. For the corrosion products of iron, such as rust, the average humidity below which no absorption occurs is 65 percent. So if rust must be left on the metal it may absorb moisture when the surrounding air is above 65 percent relative humidity regardless of the dew point. We have found a swing psychrometer with a family of curves to determine the dew point very useful in deciding whether certain planned painting jobs should proceed. This determination of good or bad painting conditions has lengthened the painting season by starting earlier in the late winter and working further into early winter. This improves the capacity factor of the equipment and painting crews. One objection to cold weather painting is the sudden drop in temperature which may occur in the late afternoon after paint application but before it has had sufficient time to dry. This may cause "crimping" of the paint film, which, though not serious, can be avoided by scheduling painting early enough in the day to insure satisfactory drying.

In brush and spray work it is important to use men thoroughly trained in this activity. In the spray gun the choice of air cap for the available pressure and of the fluid tip for the type and viscosity of paint used is important, as are the proper adjustment, care and cleanliness of the complete spray painting equipment. The exact amount of thinner recommended by the paint manufacturer should be used. Spray gun fluid tips can be chosen for paint of almost any viscosity; but, depending on the amount of solvent in the paint as received from the manufacturer, a certain amount of thinner should be added for spray gun work to offset the loss of original solvent due to volatilization during atomization. In general this should be between 10 and 15 percent thinner added to the original paint.

The flow method of applying paint on outdoor electrical equipment is relatively new, but equally simple. The equipment required consists of a 50-gal., open-end paint drum, a pump to transmit the paint to the flow head, metal trays for overflow salvage, a second pump to return the paint from the drip pans to the drum if an unusually large unit is being flowed, and hose to complete the circuit. A shower bath type of flow head is generally used, and this, with pumps and hose, is used for caustic stripping after thorough cleaning by circulating mild acid, water and then mineral spirits through them. The only part of the method calling for special training or experience is the adjustment of the viscosity or specific gravity of the paint. No fixed values can be stated, as the ambient temperature, wind, sun or shade, temperature of the equipment being painted, and the paint formulation determine its viscosity for flowing. Hydrometers or viscosimeters may be used for guides and record purposes, and the viscosity of the material may be adjusted by an experienced workman by observing the action of the paint on a large, flat stirring paddle. More reliable results may be had by using the simple Zahn viscosimeter and a stop watch. In general, the viscosity as determined by a Zahn No. 2 cup for flow painting under average conditions is between 20 and 25 sec.

Organization and Supervision

Whether this kind of work is done by outside contractors or by the utility's own forces, very close supervision is required unless those doing the work are experienced, thoroughly reliable and take an interest and pride in their work. Some phases of this work are distasteful and unpleasant, and it is difficult to find men who will attack the job with interest and enthusiasm. Therefore it is important to do everything within reason to supply equipment and working conditions to facilitate the best results. There have been cases where the best supplies and materials have been provided and plans laid to do a thorough job of surface preparation and paint application, only to have a much shorter than expected paint life due to misjudgment or carelessness.

A crew of two or three men suffices for caustic stripping, blasting or painting any one piece of equipment. When working on live equipment an extra man may be needed for safety supervision, and during blasting work an additional man may be required as an air compressor attendant.

To insure close supervision over the paint conditions of equipment and

the repainting activities in the field, we utilize the form reproduced. Stations are scattered over an area having a radius of 65 miles from the supervision center, making it difficult to know at all times just what appearance the equipment is presenting to the eyes of the local public and the local management. The upper part of the form is used by an experienced inspector, usually the painting crew foreman, to report the paint condition of all metal equipment and structures as inspected by him during the late winter months before the outdoor equipment repainting schedules start. From this survey plans are made for the next summer's repainting schedule and the necessary supplies and paint materials ordered. These survey sheets also record repainting done later. While the forms go into more detail than is required for the record of numerous small jobs, they serve as a guide and reminder for the painting foreman or inspector in the field.

When a fairly large number of stations is included in the survey, and these stations vary in size from the small distribution to the large transmission type, it is sometimes difficult to judge their relative condition so that the station needing more attention as a whole can be scheduled first in the impending program. To assist in determining which station should be scheduled first for general refinishing, a numerical rating is used for each station based on the number of individual pieces of equipment in the station and the maximum deterioration rating of each piece. It will be noted that the maximum deterioration rating as shown on the survey sheet is 3.

Therefore, a small distribution station with three power transformers and one distribution feeder switchhouse would have a denominator of $3 \times 4 = 12$, whereas a large station with a large amount of equipment, say 50 pieces, would have a denominator of $3 \times 50 = 150$. The character of deterioration having the highest rating as found during the survey for each piece of equipment is noted and these highest ratings added together to obtain the numerator so that a ratio or percentage can be determined to indicate a measure of station condition. To differentiate between simple deterioration such as "oily," "dirty," or "faded," and serious deterioration such as "peeling," "blisters," "chalking," or "mechanically damaged," the first three may be ignored in determining the actual deterioration rating, and then included to determine an appearance rating. Examples for two small stations are shown above.

It will be noted that although Station "A" has a poorer appearance rating, it is Station "B" that is in worse condition from a standpoint of paint failure.

In conclusion I wish to emphasize that the practices and methods outlined in this article do not necessarily represent the best procedure, but are published for the express purpose of stimulating a discussion.

Station "A"

Equipment	Inspection	
Transformer	03, D3, B1	Appearance Rating:
Transformer	02, D3, B2	$100 \frac{3+3+3+3}{3 \times 4} =$
		$100 \times \frac{12}{12} = 100\%$
Transformer	F3, P1, B1	Deterioration Rating:
Switchhouse	F3, B2, C2	$100 \frac{1+2+1+2}{3 \times 4} =$
		$100 \times \frac{6}{12} = 50\%$

Station "B"

Equipment	Inspection	
O.C.B.	F2, B2	Appearance Rating:
Transformer	F2, B2, O1	$100 \frac{2+2+2+2+3+3}{3 \times 6} =$
		$100 \times \frac{14}{18} = 78\%$
Transformer	F2, B2, P1	
Transformer	F2, P2, O1	Deterioration Rating:
Switchhouse	F1, B3	$100 \frac{2+2+2+2+3+3}{3 \times 6} =$
		$100 \times \frac{14}{18} = 78\%$
Switchhouse	F1, B3	

PAINT SURVEY AND RECORD FORM OF OUTDOOR SUBSTATION EQUIPMENT

Station Elmwood #2 Sub. Equipment #1 Transformer
Installation Date New — Old 1924 Serial No. 638821 Design * Tube 3
Condition of Present Paint ** O1, F3, B2, D2, P2 Date 4/10/44
Rusty Areas (location and extent) Fairly bad at upper bends of tubes - Spotty on main tank
Cleaning Method — Man Hrs. — Date —
Strip Method Caustic 2#/gal. / D3 Temp. 200° F. Man Hrs. 72 Date 5/1-5/44 Time 9-10 am
Metal Treatment #170 Water Ratio 1/3 Man Hrs. 3 Date 5/8/44 Time 10-11 am
Metal Treatment #512 Water Ratio 1/9 Man Hrs. 3 Date 5/8/44 Time 10-11 am
Prime Paint #701 Metal Temp. 70° Date 5/9/44
Thinner TT Spirits Temp. DB 70° WB 55° DP 42°
Prime Method ~~Spray~~ Brush Flow AC# — FT# — Man Hrs. 12 G.E. Visc. 27 sec. S. G. 1170
Second Coat Paint #746 Metal Temp. 70° Time — Date —
Thinner TT Spirits Temp. DB 70° WB 60° DP 53°
Second Coat Method ~~Spray~~ Brush Flow AC# — FT# — #2 Man Hrs. 12 G.E. Visc. 17 sec. 70° S. G. 1200
Finish Coat Paint #754 Metal Temp. 70° Time 10-11 am Date 5/11/44
Thinner TT Spirits Temp. DB 70° WB 65° DP 63°
Finish Coat Method ~~Spray~~ Brush Flow AC# — FT# — Man Hrs. 12 G.E. Visc. 17 sec. S.G. 900
REMARKS:

QUANTITIES OF MATERIAL USED

TSP	— #	D#512	2 1/2 gal.	Primer	20 gal.	/ Thinner	5 gal.
Sand	— #	D#170	6 gal.	Second	15 gal.	/ Thinner	5 gal.
Caustic	300 #	D#3	3 3/4 gal.	Finish	8 gal.	/ Thinner	7 gal.
Kerosene	10 gal.	SB Nozzles	—				—
AC Gas	— gal.	AC Oil	— gal.	Sovesol #4	5 gal.		—

** Present Paint Symbols: O = Oily F = Faded B = Blisters D = Dirty
C = Chalked P = Peeling or flaking M = Mechanically damaged
Use subscripts to indicate degree: 1. Minor, localized 2. Large localized areas 3. Bad generally

* Design Symbols: FR = Fixed type fin radiators Plain = No radiators (smooth tank)
Tube 4 = Boiler tube type radiators (4 layers deep) Coru = Corrugated tank.
Man DV = Manifold type radiator, demountable with valves.

PAINT SURVEY AND RECORD FORM for outdoor substation equipment

Forced-Circulation Boiler Confirmed in A.S.M.E. Sessions

Candid recital of operating experiences and evolutionary corrections of Montaup boiler indicates practicability for appropriate applications —Wide swings readily and rapidly handled—Water level stable

FORCED CIRCULATION in steam generators has had thorough wartime trial in both utility-power and industrial-steam applications and the conclusion is that it has established a position for itself wherever factors of space, investment, stringency of materials and reliability balance advantageously. This was the trend of frank disclosures and discussions at one of the power sessions of the 66th annual meeting of the American Society of Mechanical Engineers in New York, November 26-29, 1945.

Capacity and Flexibility

The unit has proven flexible as regards operation at variable pressure according to the authors, G. U. Parks (Montaup Electric), W. S. Patterson (Combustion Engineering) and W. F. Ryan (Stone & Webster). They add that "upper limit of capacity would be governed by consideration of steam purity and steam temperature rather than circulation." Wide swings in pressure, output and steam temperature have been accomplished very rapidly and with excellent degree of control when desired for special tests on the topping turbine.

Water level has been very stable even under extreme operating conditions of sudden load changes. Even when the tubes have failed it has not been difficult to maintain water level while reducing load and pressure in an orderly manner. General conclusion of the authors was that the "judgment of those responsible for selecting a bare-tube slagging-bottom radiant forced-circulation boiler for this high pressure application has been verified by its operating record."

Montaup Electric Co.'s 650,000-pound-per-hour, 960 F., 2,000-psi. forced-circulation boiler has required no structural changes nor has there been occasion for basic change in the circulation pattern since installation in 1940-42 (see ELECTRICAL WORLD, August 23, 1941). In the three ensuing years there have been 8 forced outages and 47 scheduled outages, half the latter charged to research and tests. While operated at times above rating, output was usually limited (for other station reasons) to an average monthly duty of 500,000 pounds per hour.

Tube failures have been traced to (1) solid internal deposits, (2) plugging of orifice strainer and (3) sludge accumulation at the header ends. Since these four tube failures occurred, the water has been subjected to potassium treatment with beneficial results. There have been no failures, changes or maintenance in either the convection or radiant superheater banks. Nor did the economizer experience any leaks or necessary change. All joints in the steam reheater element were seal-welded after numerous leaks at ball-and-socket joints.

In the steam drum the suction pipe screen was changed and a coverplate incorporated to eliminate undesirable turbulence. Sensitiveness to carry-over during early months whenever the water level approached the centerline led to incorporation of reversing-hood features and other minor alterations.

Circulating Pumps

Trouble developed early in the labyrinth seal of one of the pumps; minor temperature changes misaligned the shaft and it was impossible to turn it over after a shutdown. Roller bearings were installed and a mechanical seal added; the result was a sizable reduction of sealing water consumption and practically negligible leak-in of seal water into the pump. Total circulation flow appears to be independent of operating pressure and rate of output under normal operating conditions; there is, however, a marked increase in circulation when the boiler is not steaming and when the water temperature is low. Flow with one pump is about 70 percent as great as with two pumps operating; three pumps in parallel produced only 15 percent more flow than two pumps. Distribution of water has ranged from equality to a 45-55 division depending on whether the center or outside pumps were operating. Two pumps handle about 3,200,000 pounds per hour; since the water content of the boiler, exclusive of economizer, is only 30,000 pounds, this means that the water is recirculated more than 100 times per hour. Water to steam ratio is about 5 with two-pump operation.

Pump Performance

No outage of the boiler was ever caused by the circulating pumps. The pumps operate at considerably more than design capacity. Each was rated 3,500 gpm. at 184-ft. head when handling water at 630 F. and at 1,750 rpm. Tests show a head of 192 ft.; conservative pressure drop calculations for the circulatory system result in each pump passing 4,600 gpm. (rather than 3,500) when two operate and nearly 6,000 gpm. when one alone is working.

Superheat temperature is automatically controlled within ± 5 F. of the assigned limit.

Editorials

S. B. WILLIAMS, *Editor*

President's Request for Fact Finding in Labor Strife

PRESIDENT TRUMAN this week asked for industrial relations legislation that in effect would make public opinion the court of last resort. Since the Labor-Management Conference broke up without being able to come to agreement on ways to prevent work stoppages, the President stated that the public which was adversely affected had a right to know the facts and, during the time necessary to find the facts and for the public to form an opinion, work should continue as before.

Specifically did the President mention utilities among the group of industries to which this measure might be applied. The reason is obvious. In fact, there are few industries where public opinion is more important because so large a part of the public is directly affected.

While the President is not proposing that the recommendations of such fact finding panels be binding on either side, we wonder if perhaps this is not compulsory arbitration with "a distinction but not a difference." Certainly there are few organizations that would be willing to risk public indignation by going contrary to such recommendations.

The power to make recommendations under the President's proposal virtually removes from labor the right to strike and from management to lock out, except where one side or the other is willing to risk public ill will. In our opinion, the public should be permitted to make up its own mind after it knows the facts and not have its verdict made by some panel. Facts have to be interpreted and we would prefer to have the general public's decision than that of any three men whose personal philosophies, politics, relationships and sympathies could and probably would color their recommendations.

Seldom in major industrial disputes does the public ever hear all the facts. It gets the statements issued from time to time by both sides and feels perhaps the truth lies somewhere in between. Nor do the employees who are thrown out of work always know what the real issues are. For these reasons it seems as though just the threat of fact finding would stimulate efforts to reach peaceful agreement.

The question in the minds of many people is whether fact finding will work out as well in practice as in theory. It will if care is taken to insure that the investigation will be unbiased and devoted to finding facts, all the facts and nothing but the facts.

This is a new approach to the solution of industrial strife. It may not work as some people are already contending and then again it might. However, to the public at large, which pays a heavy price when work stoppages occur in important industries, particularly utilities, it would be refreshing indeed to know what is causing the trouble, why and how it can be fairly corrected.

Regulation Strays into Management Domain

ONE OF THE GREATEST DANGERS of utility regulation is encroachment upon management responsibility. After the public interest has been protected against the abuses that could and do arise out of a natural monopoly, the operating decisions should be left with management.

A case in point that seems to show unwarranted interference with management is the recent decision of the Federal Power Commission preventing the sale of natural gas to an electric utility for boiler fuel on the grounds that the plant can be operated successfully with coal and the gas is not "required by present or future public convenience and necessity."

It was brought out that coal is available within 50 to 75 miles of the plant, but if management wants to use some other fuel than that in its own backyard, that is its responsibility and not some commission's that has no responsibility for operating that plant and making it pay. Whether a plant can burn local coal successfully or not is none of the Commission's business, to state it bluntly.

Can it be that the Commission has yielded to the demands of those unions which have a selfish interest in the mining and transportation of coal to prevent this use of natural gas?

Nowhere in the Commission's releases do we find any statement that the natural gas would come from an already depleted source and that strict conservation, therefore, was necessary. In fact, the Commission left the door open to a later application for the sale of natural gas to be used in the same area for other normal civilian uses.

By what authority does the Commission decide what is best for whom and when? During the war, government through WPB did decide end uses but that was necessary due to a national emergency.

There is no emergency in this particular instance, nor does the War Powers Act cover FPC. Judging from the Commission's own release it appears that FPC has gone beyond its authorized jurisdiction in ruling on end use and in usurping management's responsibility.

Maine Stands Alone

MAINE AND VERMONT may stick together when it comes to voting for a President, but they have vastly different views on the use of natural resources. Maine has consistently taken the position that water power generated within the state should not be exported, but should be a means for bringing industry to Maine. From a reading of a recent decision of the Vermont Public Service Commission in connection with redevelopment program of the Bellows Falls Hydro-Electric Corp.'s Wilder plant on the upper Connecticut River, it would appear that the Green Mountain State does not believe that power exported from one state and utilized in another drains the former of valuable assets without adequate return. In fact, the Commission pointed out that an economic benefit originating in Vermont and utilized outside the state makes it more feasible for outsiders to purchase Vermont products through commercial exchange.

In this particular case, the present Wilder plant of 5,000 kw., without a tie-in from the outside, is a handicap to the district it serves because of dry weather shortages. On the other hand, a proper development of the river water would call for five to six times as much capacity. To be of maximum use to farmers as well as to industrials, this power must be dependable and that is exactly what the tie-in with Bellows Falls, about 40 miles distant, accomplishes. Thus Vermont citizens get, as the Commission pointed out, compensating benefits from the exporting, and so Maine now stands alone.

Utility Industry's Sound Financial Position

AT NO TIME in the past 20 years has the electric utility industry of this country been in as sound position financially as it is today. That was disclosed very emphatically in the seven-year financial record of the industry recently released by the Federal Power Commission.

Of course, the Commission gives a large measure of the credit for this remarkable result to the operations of the Uniform System of Accounts and to stronger regulatory controls. The Commission might have created better relations with the industry it regulates, without losing any credit for the part it played, if it had acknowledged the major contribution made by management. Memory of man is not so short but what many of us recall the criticism levelled by the chairman of the Commission in the early days of the war against the industry for not extending its production facilities greatly beyond what it had planned. Also do we recall how the Office of War Utilities substantially curtailed even those plans. Had the industry expanded to the extent that the chairman had insisted was necessary to meet the demands of war, its position would have been decidedly different from that shown in the report and would have given the Commission less occasion to "point with pride."

On two points the Commission can take credit, namely reduction of what it calls "inflationary items" in plant account and strengthening depreciation reserves.

Attention is called in the report to the steadily declining ratio of gross to plant investment. Since 1938 it has shown an uninterrupted improvement from around seven dollars investment per dollar of revenue to slightly over four dollars in 1944. While reduction in write-ups had some effect, the greatest factor has been the increased utilization of plant due to the 'round-the-clock character of the industrial war load. ELECTRICAL WORLD'S annual statistical issue (1-20-45), for instance, shows that the kilowatt-hours per kilowatt in that same period went from 3,000 to 4,600.

From this point on, the trend can be expected to be reversed and, while there is no reason to believe that there will be any early return to the depression levels of seven to one, it is inconceivable that anything like the four to one ratio can be achieved so long as the industry is engaged in expanding territory and adding to reserve capacity.

That interest charges were covered 3.64 times in 1944 as compared with 2.97 times in 1937 is not a measure of improved earning capacity so much as a direct reflection of the lower cost of money, plus the fact that indebtedness dropped from 55 percent to 43 percent of gross investment.

There are no records to show the financial position of the industry immediately after World War I, but it was not many years afterwards that utilities began to enjoy great popularity among speculators and financial entrepreneurs, leading to excesses that were to put the industry in the doghouse. In the meantime it has been undergoing a great cleansing and not always without considerable anguish. We feel safe in predicting that the present sound position is no springboard from which anyone will be permitted again to take off in flights of speculation.

Utility Purchases Co-op

EVERYONE REMEMBERS the old newspaperman's definition of news—when man bites dog. Last week we had just such an item—the report of the purchase by a power company of an REA co-op.

There have been any number of co-op purchases of private utility properties; in fact in the same issue we reported the purchase of two utilities at one time by a group of REA co-ops. This is the first time, however, that the shoe has been on the other foot.

In reporting this transaction there is no intimation that this is the forerunner of a number of such sales and so far as we know this is but an isolated case. It does, however, answer the question of whether or not an REA co-op can be purchased by a private utility.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

Power Policy Pot Boiling on Many Fronts

ATTENTION of the electric power industry once more is focused upon Congress, which is facing legislation of considerable consequence to the power business.

At stake are several major issues of power policy—shall the valley authority concept prevail in resource development; shall the power equipment included in the tremendous backlog of authorized multi-purpose dams be installed now or later; how widely the Rural Electrification Administration shall be financed in postwar rural line building; whether the government shall include extensive transmission networks and steam plants in big hydro and reclamation projects; whether the tax inequality between public and private power shall be eliminated, and if so, how. The answers to these and other questions will have to be hammered out sooner or later. Many should come before the 79th Congress expires a year from now.

New Slant to Duplication

An excellent example of the bitterness with which the Bureau of Reclamation and the Pacific Gas & Electric Co. are fighting the battle of California's Central Valley may be had from reading that portion of the testimony before a House Appropriations subcommittee which is devoted to the statement of PG&E President James B. Black.

At the end of the Black statement is a letter from Reclamation Commissioner H. W. Bashore—whose resignation is reported imminent—in which a hasty attempt is made to refute Black's testimony. Complaining that "the few hours at our disposal do not permit a paragraph-by-paragraph analysis of the statement in which truths, half-truths and errors are so skillfully blended," Bashore turned up with the most amusing contention to slip out of public power circles since a Senate investigating committee exposed the unnatural interest of the Rural Electrification Administration in perpetual motion. Commenting on a $6,000,000 high-voltage transmission line which the company is building from Shasta substation to the San Francisco Bay area, Bashore asserts that PG&E has no contractual grip on Shasta output which would justify such an expenditure, and adds:

"Since this construction would duplicate part of the Bureau's proposed transmission lines. . . ."

It took Mr. Bashore just 12 words to fashion a problem in semantics which should keep lexicographers revolving in their graves for years. How a line now under construction can duplicate one which has never been more than a gleam in the Reclamation Bureau's eye; how a line now abuilding can duplicate one for which appropriations have been refused several times is one for the shade of Dr. Samuel Johnson. There can be no doubt, however, that Mr. Bashore meant just what he said—that PG&E's line now building will duplicate the one Reclamation will build if it can promote the money.

Reclamation's Philosophy

Such a bland assumption of infallibility is indicative of Reclamation's philosophy and explanatory of why B of R people make such statesments as Power Utilization Director H. F. McPhail made before an intra-bureau conference in November, 1944, when he said in part:

". . . the Bureau should now assume the responsibility for supplying, in so far as possible, all additional power needs wherever it has present and potential possibilities for the generation and transmission of the needed power . . . it is desirable that the Bureau own and operate all transmission facilities."

The logical conclusion of McPhail's argument is that only Reclamation should ever in the future install generating capacity in any of the 17 western states the Bureau serves. Reclamation will develop every kilowatt-hour of hydro in them thar hills, it says here, and should that be insufficient, it apparently would not be reluctant to develop whatever steam capacity might be required. Certainly its efforts of the last three years to obtain funds for a steam plant in the San Francisco Bay area do not indicate that the Bureau feels it has no business operating steam capacity.

REA Contractor Blacklist

The latest dispute to rage around the Rural Electrification Administration—that of whether REA can dictate the blacklisting of contractors from cooperative construction while they are engaged in work for private electric utilities in competitive areas—is another in what is getting to be a long list of tempests in the REA teapot. In the past, REA has proved to be good at getting into situations which were brought indignantly to the attention of Congress. It has proved equally good at getting out of such situations unscathed in any real sense. In the light of the list of issues with which Congress must sooner or later concern itself, it isn't very realistic to expect Congress to get really steamed up about Mr. Wickard's fiat.

There come to mind some earlier situations which sent outraged citizens and legislators to the Capitol demanding that REA be whipped into line. There was the copper investigation of 1942. Then Rep. Everett Dirksen, Illinois Republican, demonstrated that former Deputy REA Administrator Robert B. Craig had juggled statistics sought by a Congressional committee, and Craig got a reprimand, while a press agent got fired. Innumerable protests were made, and investigated in committee, against REA's purchase of existing utility properties, within and without towns of more than 1,500 persons. The ex parte REA investigation of 1944 turned up a plethora of items of a scandal content far surpassing any of the foregoing. Yet REA has prospered, was given more funds this year than ever before.

The foregoing may not prove Wickard right in his position on the contractors, but on the past record, it will be difficult to prove him wrong.

NEWS OF THE WEEK

House Quickly Approves Deficiency Appropriations

Public-Private Power Ownership Fight Fails to Materialize—Central Valley Battle May Be Fought in Senate—Lower Chamber Adds Appropriation of $122,275,000 for Rivers and Harbors and Flood Control

The House failed to get excited last week about the public-private power ownership dispute contained in the first Deficiency Appropriation bill, and the measure slid quickly through and on to the Senate.

While it failed to delay the bill to fight over the Central Valley transmission lines, the lower chamber slowed up the legislation long enough to load it down with an extra $122,275,000 for rivers and harbors and flood control construction, a number of which projects call for large power installations.

Sentiment as to whether the Central Valley fight would flare up in the Senate was divided. That was conceded to be the logical course for the public-ownership-minded members of California's Congressional delegation, some of whom expressed themselves as distinctly not satisfied with what the bill contained for their pet Central Valley Project. But Reclamation Bureau sources and other members of the California delegation insisted that they knew of no specific proposals to do so.

Reclamation Bureau Pleased

In some quarters the Reclamation Bureau was pictured as being delighted that its program passed as reported, even though it was reported with major changes from its form when presented to the committee. Reclamation, one Congressman said, had failed to supply the wherewithal for the extended floor fights which it always had supplied in previous disputes. Its top people were described as feeling that the $730,000 item allowed for construction of the 230-kv. Oroville-Sacramento line was a big enough opening wedge that they could safely rest the fight until the next regular appropriation bill comes up next spring. It was generally conceded that having made that much money available, the House would not refuse the amount required to finish that particular line, from Oroville to Tracy.

Some sources, however, indicated that proponents of the Reclamation Bureau were tired of trying their case before the House, as they have done without any conclusive success or failure several times. These observers indicated that the effort would be made in the Senate where public ownership has a somewhat easier time.

The Reclamation Bureau section of the bill went through almost without debate. What argument was made was mostly concerned with the refusal of $500,000 to build a transmission line from Brush to Sterling to Holyoke, Colo., where an REA system is faced with loss of its present power source, the Holyoke Municipal System, because of inadequate capacity to meet REA and municipal loads. The line was refused in the regular appropriation last spring on the grounds the REA could finance it. Meanwhile, REA Administrator Wickard has ruled that since the co-op would take only a small portion of the proposed line's capacity, it cannot finance the line.

Other argument revolved around the refusal of funds for numerous project transmission lines out of the Fort Peck, Mont., area to load centers in that region. Funds for power market studies also were refused.

The $122,275,000 Flood Control and Rivers and Harbors item went back into the bill with a rush as representatives with projects in their districts or with some future hope of getting them demonstrated the truth of the axiom that "no one shoots Santa Claus." The Flood Control list contained 13 power projects with a total capacity installation of 1,022,500-kw., of which 70,000 is now installed in Denison and Norfork Dams. Total cost of the power features of these 13 projects is $76,338,000. Several power projects are included in the Rivers and Harbors portion of the bill.

The Federal Power Commission was given an additional $200,000 and the Securities and Exchange Commission slightly more than $166,000.

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Class I Systems Predict Higher '46 Peak Demand

Class I electric power systems estimated last month that peak demands this year will average somewhat less than one percent below last year's peak of 37,858,847-kw., and estimated that the 1946 December peak will rise to 37,955,000-kw.

These estimates, released last week by the Federal Power Commission, were submitted by more than 200 Class I electric utilities and were compiled in October and early November. The estimated 1945 peak of 37,534,523-kw. represents almost 100 percent coverage of all Class I systems, while the 1946 estimate represents 85 percent coverage and a conservative estimate for the other 15 percent.

Energy requirements will show heavier declines, these companies estimated, predicting 1945 requirements of 218,546,902,000-kw.-hrs., a decrease of 2.9 percent from last year's total. Estimates of 1946 requirements totaled 207,240,000,000-kw.-hrs., or 7.9 percent under the 1944 requirements. Shifts from wartime to standard time and a drop off in 'round-the-clock plant operations account for the energy drop.

FPC Report Shows Strength of Industry

Financial Report for Seven-Year Period Shows Growth in Reserves —Kellogg Decries FPC's Claims

The financial strength of the electric utility industry whose great war record of meeting promptly all load demands placed upon it is revealed in the "Financial Record of the Electric Utility Industry, 1937-1944," released this week by the Federal Power Commission.

The report is based on reports of utilities having electric revenues in excess of $250,000 a year and which represent, on the basis of assets, customers served, or revenues, in excess of 98 percent of the entire privately owned electric utility industry in the country.

Reflecting the continued improvement of the industry, the report shows that at the end of 1944 recorded utility plant for the industry was down some $90,000,000 from the amount at the end of 1943. This was brought about by the restatement of plant accounts to reflect actual legitimate investment. In doing this, adjustments, plus recorded retirements, actually exceeded plant additions.

Important Points Listed

Other important points of the report asserted that:

Composite reserves for the industry were increased in 1944 more than one-quarter billion dollars, and the ratio of reserve to plant was increased to 19.1 percent.

Gross plant investment per dollar of revenue was reduced to $4.08, and net plant investment (gross plant less depreciation) to $3.30.

The ratio of taxes to revenue was 20.3 percent in 1944 as compared to 21.6 percent in 1943.

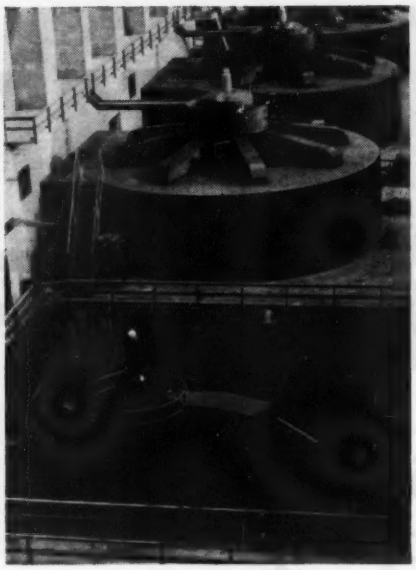
Interest charges which were covered 2.97 times in 1937 were covered 3.64 times in 1944.

The ratio of gross income to capitalization and surplus was 6.1 percent in 1944, compared to an average ratio of 5.8 percent for the entire period.

Published yield averages based on market prices of selected public utility bonds were reduced from 4.03 percent at the end of 1937 to 2.96 percent in December, 1944.

In pointing out the many improvements in the seven-year period, the report says,

"The improvement in the financial position of the electric utilities was due in considerable measure, it is believed, to the strengthening of regulatory controls, particularly the enforcement of the new uniform systems of accounts during the period under review."



ON THE WAY TO SHASTA—One of the two 75,000-kw. generators temporarily installed at Grand Coulee is shown against a back-ground of 108,000-kw. units. The smaller units are to be sent to Shasta for which they were originally intended

In New York, C. W. Kellogg, president of Edison Electric Institute, in commenting on the report said,

"It also brings out the fact that the return to investors in the industry was slightly higher in 1944 than in 1937, in spite of reducing the average charge for a unit of electricity by 15 percent during the period, while, at the same time, unit fuel costs increased 22 percent and taxes rose 110 percent.

"This is a record of public service to be proud of. It was accomplished by hard work, good management and sound engineering, and not by the strengthening of regulatory controls or enforcement of a new system to accounts, as claimed by the Federal Power Commission.

"Instead, the Commission actually burdened the operating companies with millions of manhours of labor in answering the questionnaires and preparing reports at a time when many of the experienced personnel had been taken by the armed forces and by the munitions plants, when materials were limited, and record-breaking power demands had to be satisfied."

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Delays Arkansas Hearing

The Federal Power Commission has postponed indefinitely the hearing, previously set for December 4 in Washington, concerning accounting adjustments to be made by Arkansas Power & Light.

Quick Action Likely on Reorganization Bill

The Executive Department Reorganization Bill, holding the Federal Power Commission's fate as an independent agency, is the only legislation of interest to the electric power industry which appears likely to be acted upon before Congress goes home for Christmas. This alone of four bills and one investigation was active this week.

As the Reorganization Bill went into the conference three weeks ago, the Senate had exempted FPC and the Securities & Exchange Commission among approximately 15 agencies. The House exempted only SEC and a half dozen agencies from the President's authority to reshuffle federal departments. The conference committee was expected to have its report ready by the end of this week.

Hearings of the Poage Bill, authorizing $550,000,000 for REA loan funds, have not officially been closed, although nothing further has been scheduled.

The Boren subcommittee has suspended hearings on the Holding Company Act until January 14. At that time holding company representatives will testify. Boren still hopes to bring to the stand Guy C. Myers, New York financial agent who has promoted numerous sales into public ownership.

No hearings have yet been scheduled by the Senate Agriculture Committee on the Missouri Valley Authority Bill. The Agriculture Committee is the last of three committees to consider this measure, on which adverse reports have been given by two other committees after lengthy hearings.

A subcommittee to study the St. Lawrence seaway and power project has not yet been appointed by Senator Connally. When appointed, this committee will decide whether the project should be approved by a treaty, requiring a two-thirds majority of the Senate, or by legislation which would require a majority vote by both Houses.

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War Department Loses Rate Rehearing Request

A petition filed by the War Department requesting a rehearing in its complaint against South Penn Power Co. has been dismissed by the Pennsylvania Public Utility Commission.

The commission on June 25 dismissed the complaint which alleged that billing for electric service furnished by the utility at the Letterkenny Ordnance Depot in Franklin County was not in accordance with the company's filed tariff and requested refunds.

New York Fights Federal Taxes on State Business

Supreme Court Hears Case Arising from Federal Taxation of State's Saratoga Springs Bottled Water Business—44 States, 13 Cities, and American Public Power Association Join Fight against Government

New York State Solicitor General Orrin G. Judd told the Supreme Court this week that there does not now exist any cloud on the ability of the United States to raise necessary federal income through taxation which would justify it from overruling traditional state immunity from federal taxation.

In answer to repeated questions from the bench regarding application of the "South Carolina case" to the one at bar—an appeal by New York State against federal taxation of its Saratoga Springs bottled water business—Judd pointed out that circumstances differ today from those which obtained when the Supreme Court protected the federal government's right to tax certain state functions. No income tax was permitted to be levied by the United States in those days, Judd said, and preservation of the federal government's limited tax jurisdiction was necessary if federal revenues were to be maintained. Since then, he went on, the picture has changed so much that New York State's failure to pay taxes on its bottled water business would not imperil federal revenues. In the absence of such danger, he said, the state function must go untaxed.

Freund Represents Government

Judd was the first of two attorneys supporting the State's position. He was followed by Greek L. Rice, president of the National Association of Attorneys General, who appeared amicus curiae. The government's case was presented by Paul Freund, of the Justice Department.

The state had impressive friends at bar as the two hours and 45 minutes alloted to reargument started, confined to two questions stated by the high court after it found itself unable to reach a decision on the basis of the arguments presented in December 1944.

The questions to which both sides were asked to address themselves were:

1. May Congress constitutionally include for taxation in a generally applicable taxing act any state property or activity, or the income derived by the state from them, or any other source, as long as the tax is not laid on the interest taxed merely because it is that of a state—and if income of a private person from a like source may be constitutionally taxed?

2. To what extent may a state, by enlarging its property ownership or its activities, withdraw from the reach of the federal taxing power, property and income normally subject to federal taxation when owned by private persons?

Allied with New York State were the National Association of Attorneys General and 44 states, the National Institute of Municipal Law Officers, and 13 large cities.

The New York brief took the position that a tax imposed directly on a state is invalid even though non-discriminatory. With regard to a state's right to withdraw property or income from federal taxing jurisdiction, the state argued that for such state property or income to be liable to federal tax, there must be present exceptional circumstances which lend weight to a principle in competition with the general principle that states may not be taxed by the federal government.

In a brief filed amicus curiae, the American Public Power Association argued that, insofar as federal taxation of state or municipal power activities are concerned, the government is without a leg to stand on.

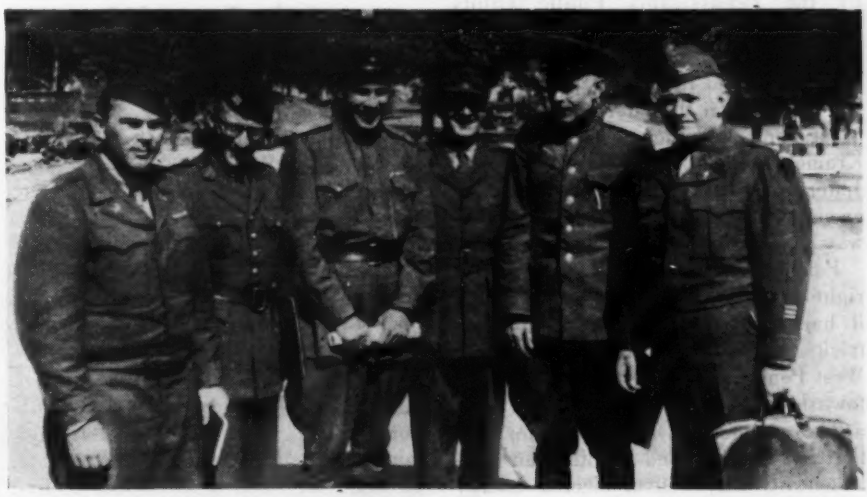
A. P. P. A.'s brief said that the basic rule, "stated many times by this court, declares that 'the instrumentalities, means and operations whereby the states exert the governmental powers belonging to them are . . . exempt from taxation by the United States'".

Congress, A. P. P. A. pointed out, has never asserted the power to tax state and local electric income or properties, and added that it doesn't seem as if it ever will, in view of the "uniform course of federal legislation designed to promote, encourage and expand municipal power ownership." The answer to Question 1 should be negative if the terms "property, income or activities" relate to a public service rendered by the state to its citizens, A. P. P. A. asserted, adding:

"Where a state causes them (electric service, etc.) to be performed under franchise, they are licensed private ventures into a governmental field."

Regarding the second question, A. P. P. A. said that if the state must show, to gain tax immunity for one of its functions, that it has traditionally occupied the field in question, (as was suggested by the high court in citing a case in the light of which arguments were to be drawn) there would be no difficulty in establishing such tradition with regard to public ownership of electric power.

"Historically, local public ownership



IN CHARGE OF GERMAN UTILITIES—Members of the Quadripartite Electricity and Gas Subcommittee of the Allied Control Authority in Germany pose before the A.C.A. building in Berlin. Left to right: Major Hollis Huggins, United States, one-time assistant superintendent of the Devon station of Connecticut Light & Power Co.; Lt. Col. Fleurquin, France; Colonel Udalov, U.S.S.R.; J. Houston Angus, Great Britain; Lt. Col. Klokov, U.S.S.R.; and Col. Walker L. Cisler, United States, formerly with Public Service Electric & Gas Co., Newark, who is returning to become chief engineer of power plants for the Detroit Edison Co.

has as long a lineage, and as distinguished an ancestry, as private ownership," A. P. P. A.'s brief asserted, adding that although the first central station steam and hydro plants were privately owned, established in 1882, there were four municipally-owned stations by the end of that year. At the end of 1944, it went on, state and municipal ownership encompassed 5,000,000 kw. of capacity and federal ownership a similar amount.

"Public power ownership as a traditional and usual function of local government has been recognized by every federal statute touching the subject," A. P. P. A. declared. "The Constitutional immunity is sustained under any standard heretofore suggested in the leading decisions of this court, that is to say, whether the activity is required to be 'strictly governmental in character,' . . . 'employed in carrying on the governmental operations of the state,' . . . 'usual governmental functions,' . . . 'activities in which states have traditionally engaged,' . . . or affording protection ' to the continued existence of the state.' "

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Pennsylvania Electric Co. Denied Right to Intervene

A request of the Pennsylvania Electric Co. to intervene in a complaint of the Northwestern Mining & Exchange Co., of Erie, against the West Penn Power Co., alleging refusal of the latter to furnish electric power at Northwestern's central power plant in Hellen Mills, Elk County, has been rejected by the Pennsylvania Public Utility Commission.

Northwestern proposes to take service of power at its central power plant, which is within the charter territory of West Penn, and then to transmit to its Kramer Mine in Henderson Township, Jefferson County, over its privately owned transmission lines and right-of-way.

Pennsylvania Electric petitioned for right to intervene on the ground that it had charter power to supply electricity in Henderson Township and that West Penn has no charter power in the township.

The commission, by a 3-1 vote, held that it is well settled law that an electric utility may deliver electric energy at a point in its charter territory for transmission by the patron for use outside that charter territory where transmission from the point of delivery to the point of use is carried out over the patron's privately owned line. Pennsylvania Electric, the commission said, therefore has no material interest.

FPC Likely to Elect Vice-Chairman Soon

Leland Olds Favored for Post—Richard Sachse and Nelson Smith Considered Rivals for Chair

The Federal Power Commission was expected this week to follow custom and elect a vice-chairman at its first December meeting.

While it would normally have all the interest appertaining to a Philadelphia-Boston National League series played late in September, the election of a vice-chairman this year will be watched with interest by commission employees and observers alike for any light it may throw on the identity of the next chairman of FPC.

Informed observers agree on one point—that the impasse which has prevented election of a chairman during the month which has ensued since the commission regained full membership probably will not be sufficiently strong to prevent the election of a vice-chairman reasonably on schedule. Customarily, a vice-chairman is elected yearly. A chairman is elected when necessary, to a term co-equal with the remaining term of the member chosen.

It appeared likely early this week that Acting Chairman Leland Olds will be reelected vice-chairman, a post he held during the last year. If so, he would automatically continue as acting chairman until a chairman is elected. It was felt that the same situation which has prevented the election of a chairman thus far will force a continuation of the status quo.

Sachse New on FPC

Some sources close to the commission believe that the contest has become one between Commissioners Nelson Lee Smith, one of two minority members, and Richard Sachse, a majority member who, although a newcomer to FPC, is a veteran of regulatory service as a result of his years with and on the California Railroad Commission.

Smith is figured to have the support of his minority colleague, Claude L. Draper, who is believed universally to have no interest in the job himself. Sachse is believed certain of the support of Olds if and when Olds determines himself not to be a candidate. In some informed quarters the feeling is unequivocal that Olds is not a candidate and that he could not win if he were one. Others believe Olds is definitely a candidate and a strong one.

One point of agreement is that Commissioner Harrington Wimberly, with Sachse a newcomer to FPC and possessor of no previous regulatory experience, is not a candidate and that he will cast the deciding vote. If this be true, the confusing element is why Wimberly, whose appointment certainly had to meet the approval of Democratic National Chairman Robert Hannegan, has not thrown his support to one of the two other Democratic members and thereby enabled a chairman to be chosen. It was pointed out that it would not be reprehensible for a new and inexperienced commissioner to cast his vote for a commission officer on a party basis.

One reason why Wimberly has not done so—if his vote is, as seems inescapable, the deciding one—lies in FPC's jealousy about the privilege of electing its own officers, as provided by the act. The late President Roosevelt, it is widely conceded, dictated the choice of one chairman during his 12 years in the White House, and the membership has been double sensitive ever since. It became apparent early in the history of the present reshuffle that Mr. Truman had no candidate; or that if he had one, that he was not prepared to make an issue of the election.

Commission observers do not anticipate any action regarding the selection of a general counsel in advance of the election of a chairman, and some feel that the latter issue may not be resolved for some months.

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C.I.O. Loses Drive to Win Union Electric Workers

American Federation of Labor locals won a decisive victory over the Congress of Industrial Organizations Tri-state Utility Workers' Union in the National Labor Relations Board election late in November to determine the collective bargaining agent for the power plant, transmission and distribution employees of the Union Electric Co. of Missouri.

The election climaxed a year-long campaign of the C.I.O. to obtain recognition from the company as the bargaining agent for all Union Electric employees. Final result of a series of elections was that the C.I.O. represents only 1,100 clerical workers.

Power plant employees picked the A.F.L. International Union of Operating Engineers, Local 148, by a vote of 768 to 135 for the C.I.O. Transmission and distribution workers picked the A.F.L. Brotherhood of Electrical Workers by a margin of 721 to 325. Employees of the Mounds Street plant in St. Louis voted overwhelmingly for the four A.F.L. unions that have been representing them for many years.

Maryland P.S.C. Approves Utility Rate-Making Base

In Dismissing Complaints against Rates Charged by Baltimore Utility, Commission Rejects FPC's Original Cost Theory for Basing Rates in Favor of State's Fair Value Law—Case Lasted Nearly 2 Years

In a decision diverging sharply from recent practice in determining rates charged by utilities, the Maryland Public Service Commission has dismissed the complaints brought against the Consolidated Gas, Electric Light & Power Co. of Baltimore by the People's Counsel and the City of Baltimore.

Unless a protest is filed with the commission within ten days or the case is taken to equity court, both gas and electric rates of the utility will remain unchanged with state approval.

However, wholesale rates at which the utility purchases some of its electric current from the Safe Harbor Water Power Corp. and from the Pennsylvania Water & Power Co. are under investigation by the Federal Power Commission.

"If a reduction in cost of purchased power should result from the proceedings now being conducted by the FPC," the state commission order said, "the electric rates should be reduced in the amount of such saving."

In two respects, the commission's decision is noteworthy. It rejected the FPC's theory of rate base determination—that of cost of property when first devoted to public service—and accepted a rate base set in 1923 by a state law which specified fair value. And the commission rejected the contention that rates of return for gas and electric operations be separated, and it allowed to continue a rate of return on combined gas and electric investment.

It was contended by some of the complainants that the practice of allowing the utility a fair return from the combined gas and electric services "was unfair to the electric customers, since the present electric rates are producing a higher return than the present gas rates, and that separate rate bases should be determined" for each service.

Consolidated immediately moved for a higher gas rate if electric rates were reduced. The commission's decision has automatically nullified this appeal.

The commission in upholding the company said:

"Having given the matter thorough consideration, in the light of all present conditions, we find that one rate base should be used for the combined services."

In regard to the rate base, the opinion said "it appears . . . that the rate base established in 1923 ($81,400,000) was determined in conformity with the Maryland law, and we believe that the commission's practice since that time of bringing the rate base up to date by adding to the 1923 base the net additions of property, at cost, and deducting the increase in the depreciation reserve is a proper one and should be continued."

Declaring the total operating income for 1944 amounted to $8,265,010, the commission said,

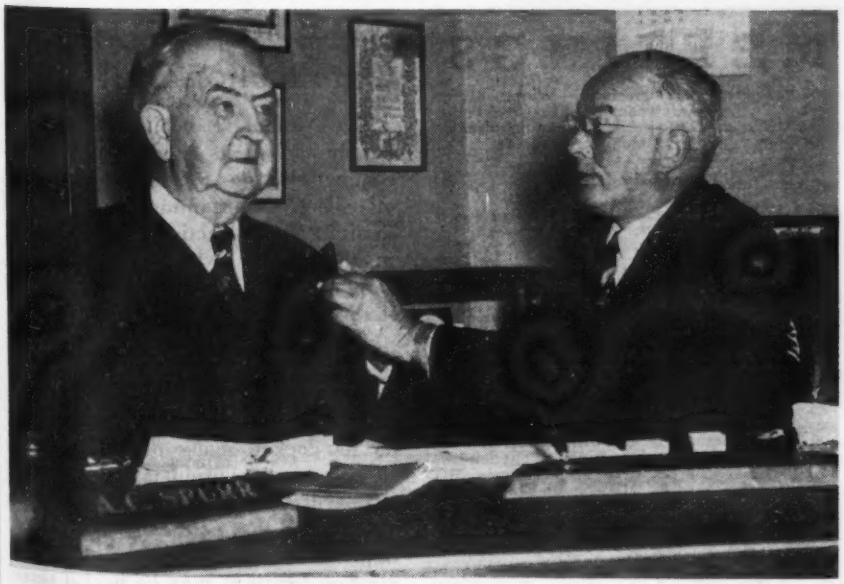
"It is very difficult to estimate from the information at hand what the operating income will be for 1946. . . . We believe it reasonable to assume there will be no substantial change. . . . We find that a return of not less than 5½ percent and not more than 6 percent would be reasonable, and these rates applied to the rate base of $148,172,126 would produce $8,149,467 and $8,890,328 respectively.

"Since the return earned in 1944 lies between these limits, we find that the present rates are reasonable and that no reduction in electric rates is justified at this time."

The case was a long and complicated one. There were 195 exhibits filed, and the case took up 5,116 pages of P.S.C. records. Proceedings were started on January 7, 1944, when the People's Counsel asked for an investigation of the utility's earnings, preparatory to conducting informal negotiations for reduction of electric rates.

The mayor and city council of Baltimore filed complaint on February 10, 1944, against the rates charged the city for street lighting and the lighting of some public buildings. It asked for open hearings instead of the proposed informal negotiations. A group of taxpayers intervened in the city's case.

Later the Rustless Iron & Steel Corp., the Bethlehem-Fairfield Shipyard, Baltimore County Commissioners, and the Office of Price Administration intervened in the interest of lower rates. The cases were consolidated for the hearing.



RECIPROCATION—A. C. Spurr, president of Monongahela Power Co., pins a 40-year pin on Vice-President J. K. Buchanan who reciprocated by giving Mr. Spurr a 20-year pin. Priorities delayed the pin to which Mr. Buchanan was entitled on April 1, 1944

Georgia Power Ups Pay

Georgia Power Co. has renewed its agreement with Local B84 of the International Brotherhood of Electrical Workers for another year. A pay increase of $10 a month was granted. Non-shift workers will receive time and a half for all Sunday work, and all workers covered by the agreement will receive time and a half for all work over eight hours in a day. The stores department for the first time was included in the agreement.

Wickard Supports REA Power Co-ops

REA financing of generating and transmission facilities to furnish power to rural electric cooperatives was defended as the rural people's "most potent defense weapon against inadequate service and exorbitant rates," by Administrator Claude R. Wickard of the Rural Electrification Administration, in a recent address before members and officials of REA cooperatives of the Red River Valley at Grand Forks, N. D.

Mr. Wickard cited the results of an REA survey which, he said, showed that power costs of REA-financed distribution cooperatives in 17 states are a million and a half dollars a year less than they would be at rates the cooperatives were paying private utilities for power before they were allotted REA loans to finance generating plants.

"It seems more than coincidence," he declared, "that the largest decreases have usually been in regions where cooperative generating plants were contemplated and were timed just after the cooperative plans were announced. It is also significant in these cases that lower rates to cooperatives were not part of a general rate decrease but were a special and sudden development.

"It is impossible to compute," Mr. Wickard continued, "how much saving accrued to the other cooperatives in the United States which, although not obtaining their power through their own generating and transmission facilities, were beneficiaries of the decrease in rates brought about by the competition which came from REA generating and transmission cooperatives. I might also add that no one can tell how many millions of dollars were saved the rural consumers of power from private utilities through the same influence."

Mr. Wickard, however, stressed that distribution facilities come first.

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New Method of Pricing Industrial Items, Dec. 11

A new method of pricing industrial machinery and other products, including wire and cable, will take effect December 11, designed to simplify methods of obtaining price relief and to increase production of machinery basic to other industries.

The changes will be contained in the following documents: Amendment No. 10 to Supplementary Order 118—Small Volume Manufacturers' Reconversion Pricing; Amendment No. 12 to Supplementary Order 119—Individual Adjustments for Reconverting Manufacturers; and Supplementary Order 142—Adjustment Provisions for Sales of Industrial Machinery and Equipment.

Under the new order, applications for individual company adjustments can be made for machinery, machine tools, parts, machinery services, farm equipment, ferrous forgings, plastics products and wire and cable. Resellers of these products will have new maximum prices or methods of setting maximum prices as they are established under the supplementary order. Retail ceilings of the few products that are sold to consumers will generally be held to 1942 levels.

K ---stands for KNOXVILLE, "the citizens of an incorporated municipality."

U ---stands for UTILITIES, "electricity, gas and water."

B ---stands for BOARD, "a council of directors authorized by the citizens."

A KUB IS BORN—In line with the present trend of simplification of names of utilities, Knoxville Electric Power & Water Board is now the Knoxville Utilities Board. KUB derived from the utility's initials has been designed to add life to the advertisements and property of the board

MEETINGS

Canadian Electrical Association—Winter conference, Chateau Frontenac, Quebec City, February 11-12. B. C. Fairchild, managing director, 704 Tramways Bldg., Montreal, Canada.

Previously Listed

American Institute of Electrical Engineers—Winter convention, New York, N. Y., January 21-25, 1946. H. H. Henline, secretary, 33 W. 39th St., New York 18, N. Y.

Institute of Radio Engineers—Winter technical meeting, Astor Hotel, New York, N. Y., January 23-26, 1946. Haraden Pratt, secretary, 330 W. 42nd St., New York 18, N. Y.

Pennsylvania Electric Associations—Systems operation committee, Roosevelt Hotel, Pittsburgh, Pa., February 6-7; A. R. Deck, chairman, Metropolitan Edison Co., 412 Washington St., Reading, Pa. Transmission and distribution committee, Benjamin Franklin Hotel, Philadelphia, Pa., February 7-8; C. C. Moler, chairman, The Potomac Edison Co., Hagerstown, Md., Electrical equipment committee, Roosevelt Hotel, Pittsburgh, Pa., February 14-15; B. E. Hagy, chairman, Philadelphia Electric Co., 900 Sansom St., Philadelphia, Pa.

Missouri Valley Electric Association—Power sales conference, Hotel Continental, Kansas City, Mo., February 13-14. I. D. Pettegrew, director, 1004 Baltimore St., Kansas City 6, Mo.

NEMA Announces Results of Election

Officers of the National Electrical Manufacturers Association, who were elected in a ballot taken by mail because the annual meeting had been cancelled, have been announced in New York.

Richard L. White, president of Landers, Frary & Clark, New Britain, Conn., (See Page 211) will succeed A. C. Streamer, Westinghouse Electric Corp., as president.

Vice-presidents selected were W. C. Johnson, vice-president of Allis-Chalmers Manufacturing Co., Milwaukee; R. W. Turnbull, president of Edison General Electric Appliance Co., Chicago; H. E. Blood, president of the Norge Division, Borg-Warner Corp., Detroit; J. K. Johnston, vice-president of National Vulcanized Fibre Co., Wilmington, Del.; and Everett Morss, president of Simplex Wire & Cable Co., Cambridge, Mass.

R. S. Edwards, president of Edwards & Co., Norwalk, Conn., was elected treasurer.

Two new members elected to the Board of Governors were C. T. Lawson, vice-president of the Kelvinator Division, Nash-Kelvinator Corp., Detroit, and E. L. Robinson, vice-president of Crescent Insulated Wire & Cable Co., Trenton, N. J.

Named to the Officers Committee as representatives of the Board of Governors were E. O. Shreve, vice-president of General Electric Co., Schenectady, and C. L. Collens, president of Reliance Electric & Engineering Co., Cleveland.

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NLRB Regional Leaders Get Election-Call Power

The National Labor Relations Board has authorized its regional directors to conduct elections for the determinations of collective bargaining agents without awaiting formal action by NLRB itself in those cases where union and the employer are in substantial accord as to the details and scope of the election.

The move was taken in an attempt to speed up collective bargaining processes before NLRB, which now has about 2,100 bargaining election cases on its docket, many of them tied up to reconversion problems.

Board Chairman Paul M. Herzog emphasized that neither party would be deprived of any rights and that post-election hearings may be held if necessary. The new procedure, he said, will supplement and not replace existing procedures.

Idaho Power Co. Strives for 100 Percent Coverage

Already serving 90 percent of the rural and farm customers within its service areas, Idaho Power Co. has launched expansion plans to make electricity available to the remaining 10 percent, C. J. Strike, president, has announced.

The American people have expressed their desire that all agricultural people have the benefit of rural electric service, Mr. Strike said. He added that in his belief this service can be most economically furnished by the agency serving urban business in a particular geographical area.

All district managers of the company were authorized to proceed with necessary preliminary steps for the expansion, using a ratio of six dollars to be invested in facilities for each dollar of prospective annual revenue. The company's previous policy on rural extension had been on a 4½ to one basis. The managers also received applications for service and were instructed to proceed with the signing of requests.

Idaho Power at present furnishes electricity to customers in southern Idaho and western Oregon. All rates are set by the same residential schedule.

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Eldorado, Ill., Wants Light, Votes Utility 50-Year Stay

Illinois Power Co. won a 50-year franchise in a special referendum held recently in Eldorado, Ill., by a vote of 868 to 574, and street lights are burning once more. The city owed the utility $7,761 for street lighting; so several months ago when the utility lost its franchise, the street lights were turned off. On election day, City Judge Harry Flanders issued a mandatory injunction ordering the utility to switch on the street lights, and this was done before the ballots were counted. The utility has also cancelled the old light bill.

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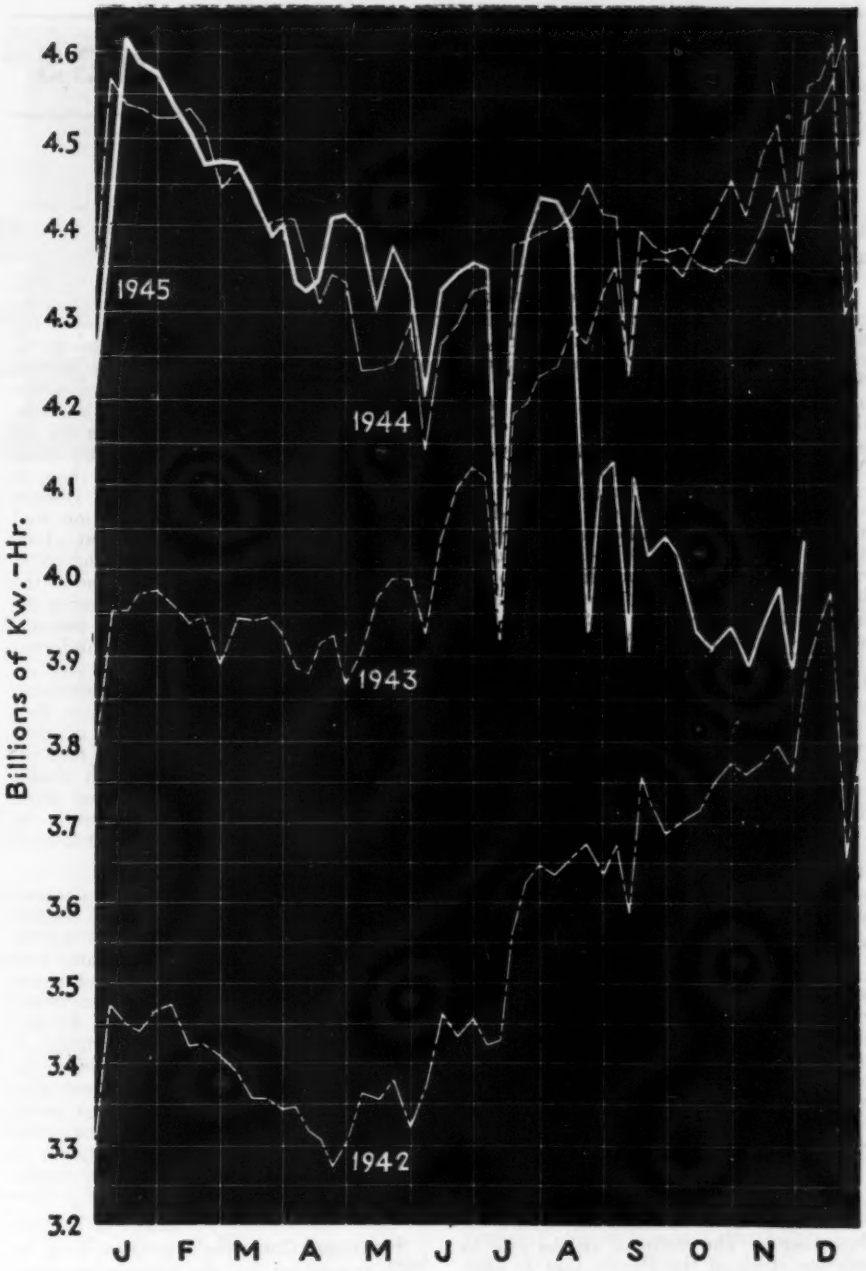
Nebraska Power Ups Pay

A $20 a month increase for all employees of Nebraska Power Co. went into effect November 1. The raise was negotiated on behalf of union employees by Local B763, International Brotherhood of Electrical Workers, which represents operating and distributing employees.

T. H. Maenner, chairman of the board, said the raise also applied to unorganized workers. The increase amounts to 12½ percent of the total payroll.



Output Curve Swings Sharply Upward

The electric output curve swung upward during the week ended December 1, 1945, reaching the highest point since mid-September, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry totaled 4,042,915,000 kw.-hr., compared with 3,841,350,000 kw.-hr. during the preceding week. During the week ended December 2, 1944, the amount of electrical energy distributed amounted to 4,524,257,000 kw.-hr., this year's figure representing a decrease of 10.6 percent.

All of the major geographical regions of the country reported losses for the week ended December 1, as compared with the corresponding week last year.

Weekly Output Millions Kw.-Hr.

1945		1944		1943	
Dec. 1	4,043	Dec. 2	4,524	Dec. 4	4,560
Nov. 24	3,841	Nov. 25	4,369	Nov. 27	4,403
Nov. 17	3,985	Nov. 18	4,450	Nov. 20	4,513
Nov. 10	3,948	Nov. 11	4,397	Nov. 13	4,483
Nov. 3	3,899	Nov. 4	4,355	Nov. 6	4,414
Oct. 27	3,937	Oct. 28	4,358	Oct. 30	4,453
Oct. 20	3,915	Oct. 21	4,345	Oct. 23	4,415
Oct. 13	3,934	Oct. 14	4,355	Oct. 16	4,382
Oct. 6	4,028	Oct. 7	4,375	Oct. 9	4,342
Sept. 29	4,039	Sept. 30	4,366	Oct. 2	4,359
Sept. 22	4,019	Sept. 23	4,377	Sept. 25	4,360
Sept. 15	4,106	Sept. 16	4,395	Sept. 18	4,359

Percent Change from Previous Year

	Week Ending		
	Dec. 1	Nov. 24	Nov. 17
New England	— 4.0	— 7.1	— 6.4
Mid Atlantic	— 3.7	— 5.7	— 4.4
Central Industrial	— 12.8	— 12.9	— 12.9
West Central	— 1.4	— 4.4	— 1.8
Southern States	— 15.7	— 16.5	— 14.8
Rocky Mountain	— 0.8	— 5.8	— 0.5
Pacific Coast	— 13.0	— 15.0	— 12.3
Total United States	— 10.6	— 12.1	— 10.5

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

ASSOCIATED ELECTRIC CO., not having as yet surrendered to Missouri Southern Public Service Co., a wholly-owned subsidiary, the capital stock of the latter, and Missouri Southern Public Service Co. not as yet having been dissolved, in connection with the sale by Missouri Southern Public Service Co. of all its physical properties to New-Mac Electric Cooperative, Inc., the commission has extended the time for consummating the transactions involved to and including May 1, 1946. In the original application Associated and Missouri Southern sought permission for Missouri to sell its properties to the cooperative for a base cash consideration of $170,000; the subsequent transfer by Missouri Southern of 40 shares of capital stock of Atlantic Utility Service Corp. and its other then remaining assets, subject to its liabilities, to Associated Electric Co. and the surrender to Missouri Southern Public Service Co. of all its capital stock and indebtedness held by Associated Electric Co. and the dissolution of Missouri Southern. The commission granted the application, but last September the applicants advised it that they have been unable to consummate completely the transaction proposed. The new order of the commission gives the extension of time. (Release No. 6186).

CENTRAL ILLINOIS PUBLIC SERVICE CO.'s proposal to issue and sell to certain banks unsecured notes in the aggregate principal amount of $5,600,000 and to use the proceeds to prepay and redeem a like principal amount of unsecured serial notes now outstanding and bearing interest at 2¾ and 3 percent has been approved. (Release No. 6238).

NORTH AMERICAN CO. has been authorized to pay a dividend on its common stock on January 2 to holders of record of December 3. The dividend will be paid in common stock of the Pacific Gas & Electric Co. at the rate of one share of Pacific for each 100 of North American. (Release No. 6239).

PENNSYLVANIA POWER & LIGHT CO., a subsidiary of National Power & Light Co., intermediate holding company in the Electric Bond & Share System, entered the SEC picture last week, when the commission released its jurisdiction over provisions designed to protect the interests of members of the armed services overseas, in connection with the recapitalization of the company. The recapitalization plan included a provision for the issuance by Pennsylvania of 1,818,700 shares of new common stock through an offer of rights to subscribe to such shares to National, which, in turn, will offer such rights to its own stockholders on a pro rata basis at $10 a share. For the protection of armed forces overseas, National, at the commission's suggestion will include in its offer of rights the provision that any stockholder of record of National on Dec. 4, 1945, and then a member of the armed services, who establishes within ninety days after discharge that he was overseas during the subscription period, shall receive from National an amount equivalent to the value of the subscription warrants issued to such shareholder. (Release No. 6241).

NORTHERN STATES POWER CO. of Delaware's petition, requesting a rehearing on SEC's order of October 29, which directed the company to furnish a list of its preferred stockholders to a committee representing certain 6 and 7 percent preferred stockholders has been denied by the commission. The committee desires the list in order to solicit authorizations from other holders of such stock to represent them in all proceedings before the U. S. District Court now considering an application filed by the commission for enforcement of its order approving the plan of dissolution of the company. The committee opposed the plan before the SEC. The commission ordered the company to furnish the committee with its most up-to-date list of preferred stockholders. In another matter with respect to Northern States, the commission denied as without merit a motion filed by Paul Christopherson, a holder of class A common stock of the company, requesting a finding by the agency which would, in effect, bar the class B common stock from participation in the liquidation of Northern States Power Co. of Delaware. (Release No. 6243 and 6244).

OKLAHOMA POWER & WATER CO.'s proposal to issue and sell to banks $3,200,000 of promissory notes, bearing interest at 2 percent, maturing in three years, and to use the proceeds to prepay and retire $550,000 face amount of old 2 percent notes now held by banks, and to redeem $2,761,000 principal amount of first mortgage, 5 percent twenty-year gold bonds, Series A, has been approved. Oklahoma Power also proposes to issue $3,200,000 of first mortgage 4 percent bonds, Series D, maturing Sept. 1, 1940, secured by its mortgage of Feb. 1, 1928, and pledge the new bonds as collateral for the new notes. (Release No. 6197).

SOUTHERN COLORADO'S petition filed in 1943, requesting that the commission enter an order waiving the jurisdiction heretofore reserved by the commission with respect to the payment of the fees and expenses incurred by the company in connection with its plan to conform with provisions of the Public Utility Holding Company Act, has been granted. (Release No. 6236).

Hearing Scheduled

DECEMBER 12: On proposal of Central Power & Light Co. to sell its electric and ice properties in four Texas counties to West Te as Utilities Co. for $815,000 in cash. (Release No. 62?0).

UTILITY REPORTS

	Net Income 1945	1944
*Arkansas Power & Light...	$ 2,576,449	$ 1,259,938
*Carolina Power & Light...	2,341,789	2,408,286
†Commonwealth & Southern and subs	14,768,539	14,246,082
†Dallas Power & Light.....	1,418,152	1,344,395
†Detroit Edison and subs..	6,372,403	7,776,596
*Louisiana Power & Light..	1,187,618	812,022
*Mississippi Power & Light.	654,433	1,415,944
*Montana Power	3,970,494	4,047,985
*New Orleans Public Service	2,108,812	1,596,026
*Pacific Gas & Electric.....	22,032,827	23,013,200
*Pennsylvania Power & Light	5,120,667	5,621,823
†Utah Power & Light and sub	1,854,082	1,926,043
*Washington Water Power..	2,142,101	2,596,809

*Twelve months ended September 30.
†Twelve months ended October 31.

International Light Show Scheduled for April 25-30

The first International Lighting Exposition and Conference will be held April 25-30, at the Stevens Hotel, Chicago, under the auspices of the Industrial and Commercial Lighting Equipment Section of the National Electrical Manufacturers Association. The conference was originally scheduled for last spring but was postponed because of travel restrictions.

A series of lighting conferences at which nationally recognized authorities will discuss the latest trends in lighting practice and lighting sales training has been scheduled.

Exposition manager is A. B. Coffman, 111 W. Jackson Blvd., Chicago 54, Ill. The committee in charge is headed by E. C. Huerkamp, Westinghouse Electric Corp., and includes S. R. Naysmith, The Miller Co.; R. W. Staud, Benjamin Electric Mfg. Co.; A. A. Overbagh, Overbagh & Ayres Manufacturing Co.; F. I. Wilson, F. W. Wakefield Brass Co.; W. P. Lowell. Jr., Sylvania Electrical Products; D. J. Biller, Day-Brite Lighting; and F. J. Martin, NEMA.

World Power Conference Will Hold Meeting in 1947

Time and place for a sectional meeting of the World Power Conference during 1947 will be set by the International Executive Council in Paris next spring, according to a recent announcement by the Council in London.

Representatives of about 20 countries, including the United States, voted to discuss the general question of fuel economy at the 1947 meeting and to resume publication as soon as possible of the statistical yearbook.

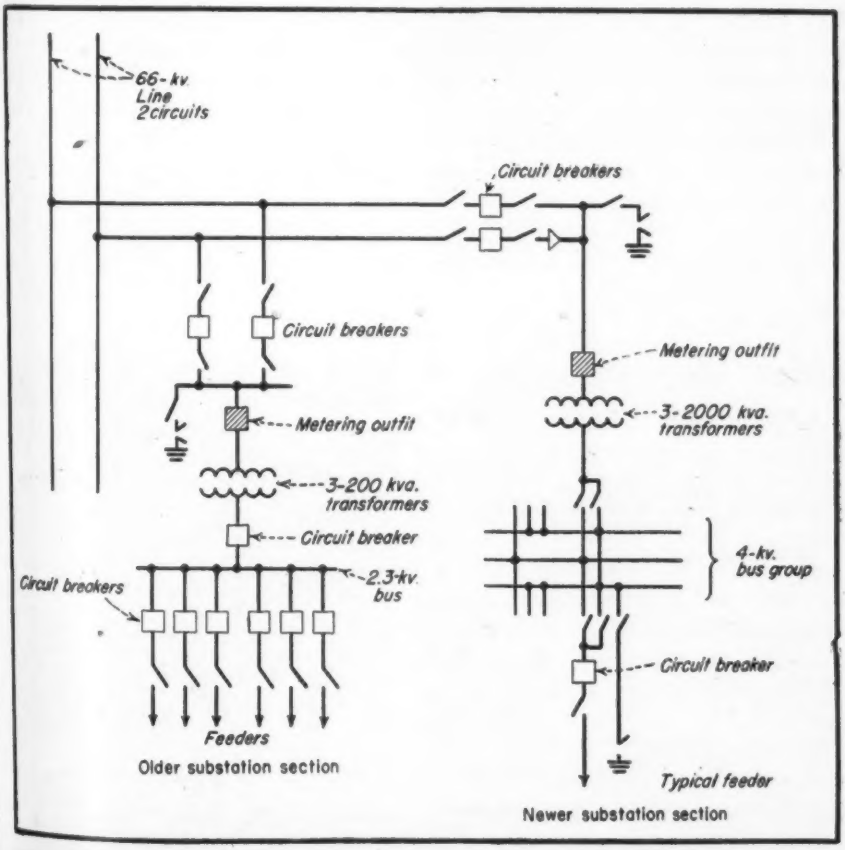
Utility Gives Pay Increase

Non-management employees of the Connecticut Light & Power Co., totaling 1,700, received a pay increase of about 13 percent on December 2, and on the same day the company returned to its normal 40-hour week.

How

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

AMPLE SPACE FOR INCOMING SERVICE and high-voltage transformer installation features facilities for enlarged military post; 4-kv. feeder system added



SINGLE-LINE DIAGRAM of original and expanded substation facilities showing provision for 4-kv. feeder buses to cover wider areas

Substation Capacity Increased Tenfold

In an eastern military post formerly supplied with 2.3-kv. distribution facilities the requirements of expanding operations including personnel reception, training and hospitalization demanded the installation of 6,000 kva. in transformer units near an original installation of 600 kva., and the construction of a 4-kv. feeder system to reach areas remote from the earlier load centers. The job was handled by utilizing the same 66-kv. transmission supply line which fed the post at the beginning, retaining the 200-kva. units in their previous location, continuing to use the 2.3-kv. feeder system within its capacity limitations and providing virtually a new substation for the expanded load as shown in the accompanying illustrations. Metering outfits at 66-kv. rating serve each section of the substation supply facilities, and reclosing type breakers were installed in the 4-kv. feeders to support the greater service demands of the expanded load.

Subsidiary substations stepping down to 2.3 kv. and transformers serving pumping and other power loads were installed at strategic points on the reservation. The new substation section was located on ground affording ample space for separating incoming 66-kv. line breakers and lightning arrester equipment from the transformer bank and 4-kv. arbor and feeder breakers, and wooden pole structures were effectively used in the high line entrance section. In the 4-kv. section operating flexibility was greatly increased by designing the switching facilities to enable any

feeder to be supplied from any bus, the original installation or older substation section having been restricted in this connection to a single bus layout with non-reclosing breakers.

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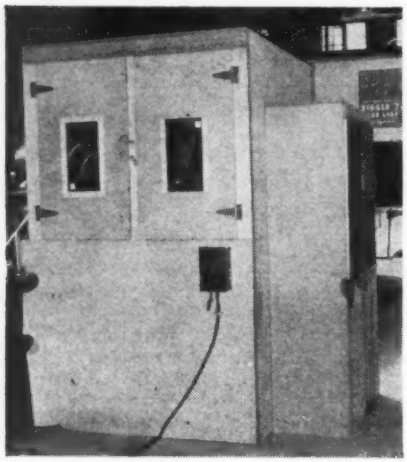
Filters Keep Dust out of Exciter Commutator

A. W. FRANCIS

Mechanical Engineer
Central Illinois Electric & Gas Co.
Rockford, Ill.

Until temporary air filters could be set up to remove it, concrete dust raised by drills working on the turbine floor at Rockford station of Central Illinois Electric & Gas Co. threatened to destroy the commutator of a self-cooled exciter associated with one of the station's 15,000-kw. generating units.

Although steps were taken to minimize the volume of dust liberated by the air drills, some concrete dust was getting under brushes on the machine and cutting the commutator badly. It was also lodging between the brushes and holders of exciter and field collector rings, causing brushes to stick and overheat. Until the condition was remedied it was necessary to shut the entire generating unit down every couple of weeks to clean the exciter and collector ring brushes.



EXCITER HOUSING made of building board and fitted with filters and fan keep concrete dust from damaging the commutator of a self-cooled exciter during plant construction

To keep dust out of the exciter a temporary three-sided housing of building board, shown, was thrown around the exciter. Cooling air was drawn into the housing through four viscous-impingement type filters by a blade-type induced draft ventilating fan and discharged through the open side of the housing after passing over the exciter. Air pressure within the housing prevented dust from entering except through the filters. Velocity of air leaving the open end of the three-sided housing was sufficient to prevent entrance of the dust there.

Since the filters have been installed it has not been necessary to shut the machine down to clean the exciter. The filters, however, are cleaned about every two or three weeks. The exciter operates about 5 deg. warmer than without the housing but this is not considered serious.

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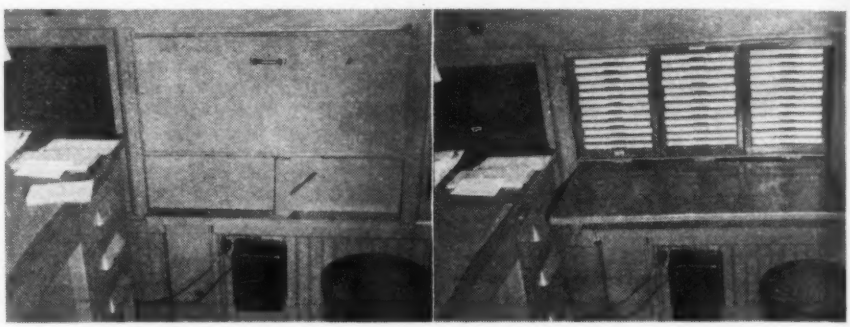

OPEN AND CLOSED VIEWS of Globe-Wernicke files housed in steel cubicle which is built into office wall. Office is on mezzanine floor; cubicle overhangs operating floor

Meter Record File Housed in Cubicle in Wall

Building a cubicle for the meter records near the meter clerk's desk removed two basic difficulties in the office of the Westfield, N. Y., municipal system. It lessened the time necessary to find and impart information over the telephone and saved the customer from becoming irritated while waiting.

Previously, due to lack of space near the desk, the files were kept at the end of the room approximately 35 ft. away. Upon receiving a request for information, the clerk would walk to the file, make proper notes upon a pad and return to the telephone. All this was time consuming and often irritating to the customer.

To overcome this difficulty, Harry Mettendorff, superintendent, devised and constructed the illustrated meter record arrangement. It is at the meter clerk's elbow, convenient to the telephone and "out-of-the-way." When closed, it forms a part of the wall; when open, a handy shelf is available which avoids the necessity of the clerk even turning to the desk.

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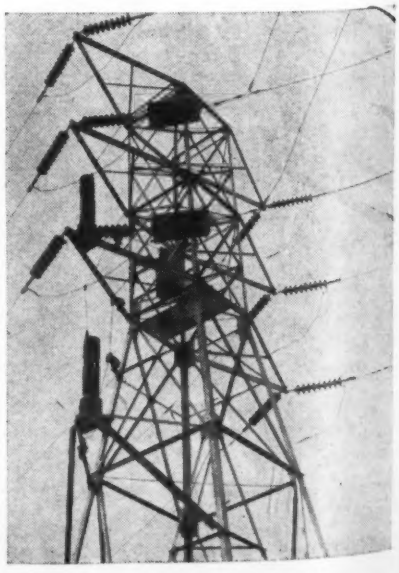
Install Carrier Telephone Equipment on Line Tower

J. L. BUCKLEY

Assistant Engineer,
Pacific Gas & Electric Co.,
San Francisco, Calif.

Special conditions often make it necessary to mount equipment in unusual locations. Such a case is shown in the accompanying illustration where carrier telephone equipment is mounted in a 110-kv. tower of the Pacific Gas & Electric Co.'s Big Bend-Oakland line. The equipment consists of two 400-amp., two frequency



MOUNTING CARRIER EQUIPMENT in line tower saved expensive 110-kv. tap to a nearby substation

line traps mounted in the lines in the usual way, two carrier current coupling capacitors and a line tuning unit with its adjusting platform mounted approximately 50 ft. above ground.

It was also necessary to install a support for the lower capacitor and to strengthen the crossarms to carry the additional load. Transmitter and receiver units in a nearby substation are connected to the equipment in the line tower by 1,500 ft. of conduit and carrier current concentric cable. This method of mounting the coupling capacitors, traps and tuning unit saved an expensive 100-kv. tap into the substation.

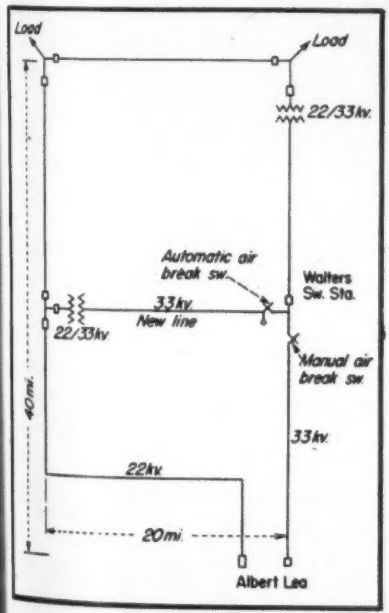
•

Automatic Switch Saves Investment in Breaker

PAUL NANEY

Asst. Chief Engineer
Interstate Power Co.
Dubuque, Iowa

Having built a 16½-mile 33-kv. tie line across a 40 by 20-mile transmission loop to increase its capacity and secure better voltage regulation, engineers of Interstate Power Co.



LOOP CIRCUIT SERVICE to major loads at top corners of loop is insured in event of fault on tie line by use of one automatic motor-operated air break switch and one manual switch arranged as shown above

were faced with the problem of providing switching facilities at Walters switching station that would give service around the loop and to important heavy loads at the top corners in the event of a fault on the new tie line.

This objective was achieved by using two 69-kv. air-break switches; one automatic, and the other manually operated. The arrangement is shown. The manually operated switch was installed on the Albert Lea side of Walters switching station and the automatic switch, which was arranged to open on loss of voltage after a time delay, was placed in the tie line circuit also at Walters.

Fault Occurrence

Thus when a fault occurs on the 33-kv. cross-loop tie line, the Albert Lea breaker will trip and reclose immediately. If the fault persists this breaker will trip and reclose in five seconds. If the fault still persists this breaker will trip again and remain open long enough for the automatic switch at Walters to open. The Albert Lea breaker will then reclose before the last trip and lockout.

This arrangement was adopted in preference to installation of breakers at Walters station because the possibility existed of an eventual voltage boost on the loop. It was considered more economical to purchase and install 69-kv. automatic air-break switches in advance of the projected voltage change than to tie up in advance the considerable amount of money that would have been required for 69-kv. breakers.

Manhole Switch Simple, Positive in Action

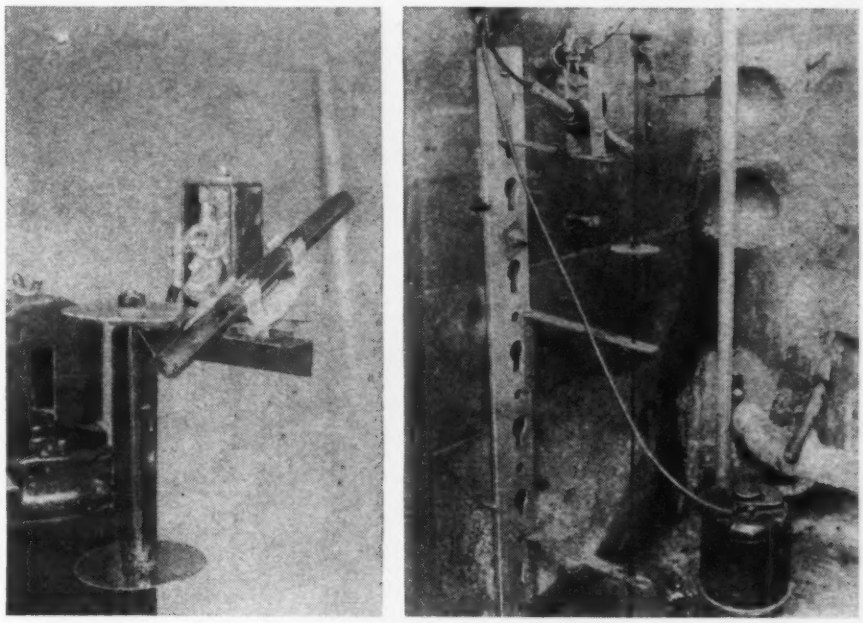
Features of a recently designed switch which enhances its use in manhole pumping installations are:

1. Delayed response is incorporated in the linkage mechanism.

2. Fibre tube which is tilted by the float operated disks contains a ball which rolls to the low end and thereby makes it impossible for the switch to freeze on dead center.

This switch was developed by Frank W. Brady of the Philadelphia Electric Co. to eliminate damage to manhole pumping equipment due to failure of installed float switches. These failures had been resulting in approximately 10 flooded motors per month and caused a maintenance problem on a 33-kv. duct run.

The disks on the float-actuated bar rise and fall with the water elevation, tipping the fibre tube, which causes the ball to roll to the low end, which, in turn, causes the switch to have a positive "make and break" action. This type of switch has been in operation for approximately two years and has been completely satisfactory.



DETAILS OF SWITCH-ACTUATING MECHANISM (left): method of mounting switch and guiding a float-actuated rod (right), for manhole pumping

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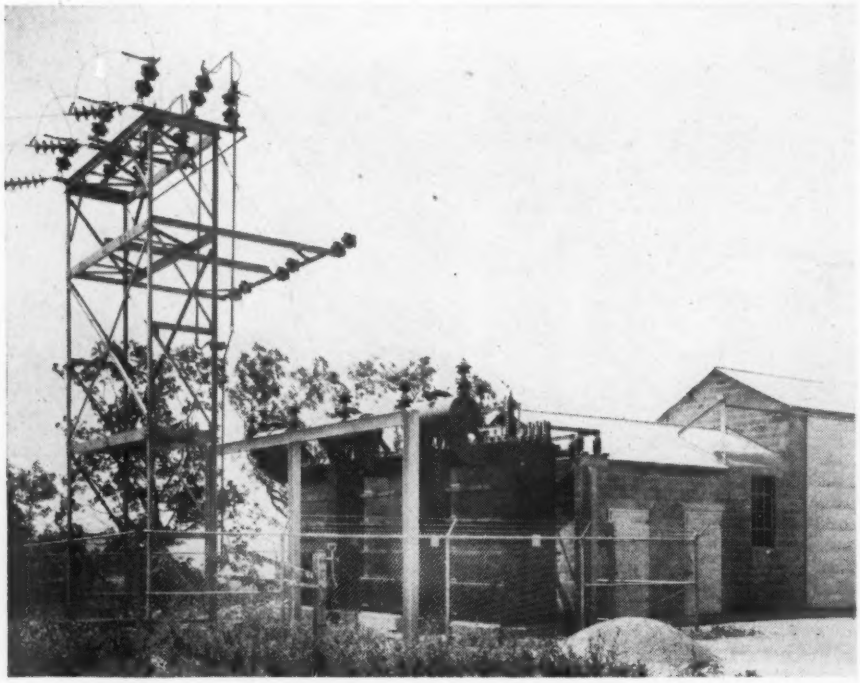
"On-Line" Test Station Electrical Features

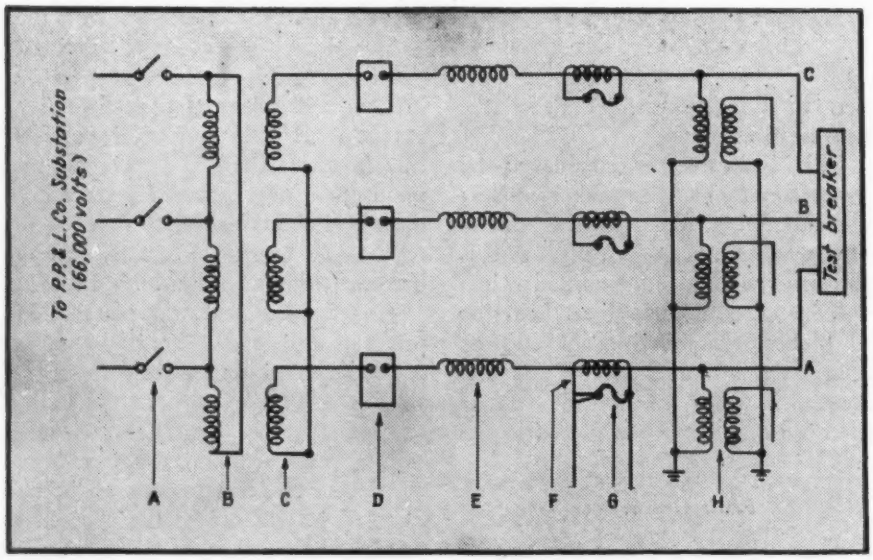
A. R. MILLER
Development Engineer, Roller-Smith Co., Bethlehem, Pa.

Equipment manufacturers try to gather as much data as possible on the operating characteristics of products and their ability to "stand the gaff" under actual operating conditions. To obtain this type of information on circuit breakers, the engineers at Roller-Smith designed and constructed a test station which has heavy back-up capacity, several available test voltages, and facilities for controlling test condition and measuring test results.

This "on-the-line" test station is connected to the Pennsylvania Power & Light Co.'s. Siegfried substation by a 900-ft. 66-kv. line. While the total interconnected short-circuit capacity at the substation is 1,250,000 kva., only a portion of this is needed to test the breakers and consequently the test station has reactance which limits the short circuit to 250,000 kva., or about 20 percent of that available.



"ON-THE-LINE" test station showing incoming 66-kv. line, disconnect switches, and power transformers. Back-up breakers and reactors are located in the smaller building and the breaker test room is in the large building



HEAVY CURRENT CIRCUIT of the testing station: A is disconnect; B, primary winding of transformer; C, transformer secondaries; D, back-up breakers; E, reactors; F, current transformers; G, oscillograph shunts; and H, potential transformers

The disconnecting switches, transformers and back-up breakers are an integral part of the test station and the back-up breakers are set to operate before any serious voltage disturbance can occur. The oscillograph recording equipment is located in a separate building which is located about 75 ft. from the breaker test floor.

The high side of the three single-phase transformers have five 10 percent taps to provide voltage adjustment. The secondaries of each transformer consist of four 2,250-volt windings which may be connected delta or wye and in series or parallel in each case. Full capacity three-phase tests may be made on the center tap where the following voltages are available:

Delta Connection	Wye Connection
2,250	3,900
4,500	7,800
9,000	15,600

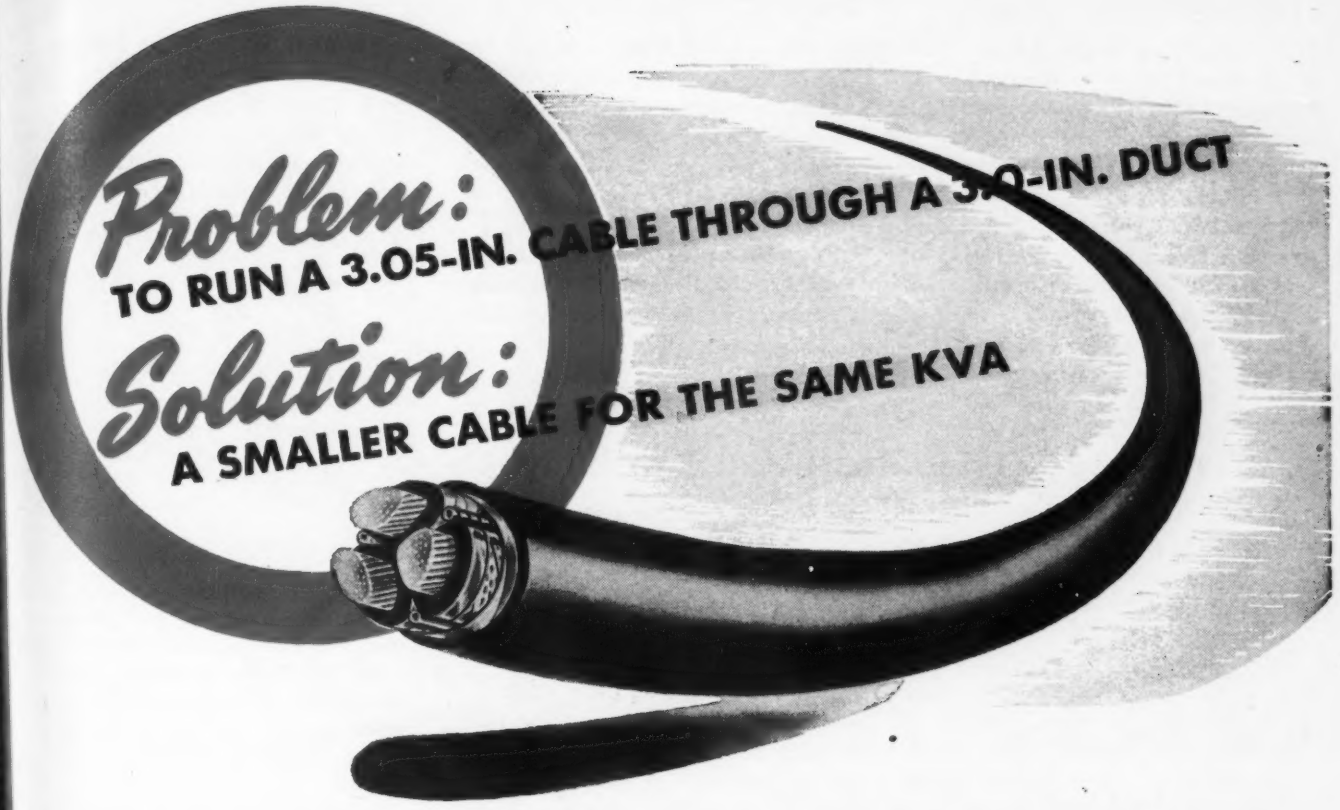
By means of the tap changers on the high side, two 10-percent steps above these voltages and two 10-percent steps below the voltages are available. The transformers can be paralleled on one phase for high-current single-phase testing.

Each transformer is also provided with a two-section tertiary winding which, when connected in parallel, gives 300 volts and, when in series, 600 volts. These windings are especially designed and braced to give extremely high short-circuit currents. Impedance is such that short-circuit current at the terminals for a three-phase short is 270,000 amp. at 300 volts and 135,000 at 600 volts. By paralleling the banks, 450,000 amp. are available for single-phase testing.

Reactors

The reactors are especially designed for this installation and are connected two per phase. They provide 14 steps of impedance for testing from 25,000 kva. to 250,000 kva. In addition to the bracing required to withstand the short circuits, it was found necessary materially to increase the insulation (to withstand the surge voltage at the time of circuit interruption) over the insulation usually required.

In order to avoid any disturbance



G-E GAS-FILLED CABLE MET THIS CHALLENGING NEED

FOR NEW ENGLAND UTILITY

Additional load demand in one section of the city created a problem for the Hartford Electric Light Company. The need was for a new cable to carry at least 15,000 kva. The only available duct along part of the route, however, was one having an inside clear diameter of 3 inches in some sections.

Various sizes and types of cable were considered, but most were ruled out by the mechanical limitations of the duct even when it was rodded to 3¼ inches. The 27-kv, 500,000-cir mil solid-type paper-insulated cable which would have done the job had an outside diameter of 3.05 inches. This did not allow sufficient clearance for pulling.

The choice was G-E gas-filled cable—27-kv, 500,000-cir mil, having a maximum diameter of 2.8 inches. More than 18,000 feet was soon installed, and service has been uninterrupted ever since.

In addition to solving the immediate problem posed by size, other benefits were obtained:

1. GAS-FILLED CABLE IS SELF SUPERVISING. When a leak occurs, an alarm is actuated by a simple pressure relay. Valving additional nitrogen into the cable protects it, and keeps the cable in service until it is convenient to make repairs.

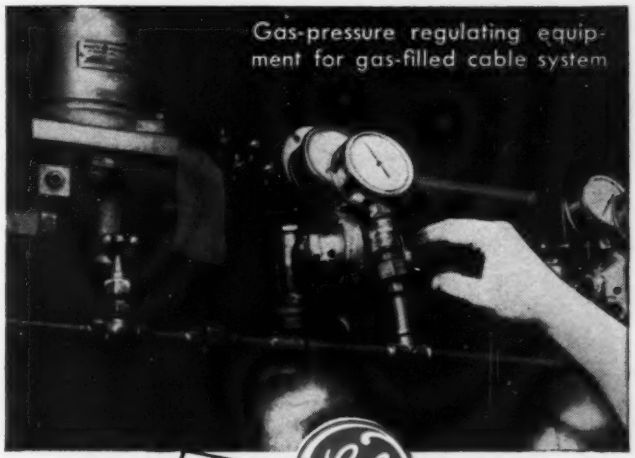
2. FAILURES AND SERVICE INTERRUPTIONS ARE MINIMIZED. Pressure is maintained at low, uniform level (10 to 15 lb per sq in.) inside the cable. There are no destructive pressure rises during load cycles and temperature changes.

3. NO PROFILE PROBLEMS. Unlike solid-type cable, there is no migration of compound on either steep grades or vertical risers.

4. AMPLE OVERLOAD MARGIN. A 15 per-cent overload in gas-filled cable imposes no excessive internal stresses on the lead sheath.

5. LOW INSTALLATION AND MAINTENANCE COSTS. Gas-filled cable costs little if any more to install than solid type. Ease of locating breaks through direction of gas-flow keeps maintenance cost low.

For more information on General Electric gas-filled cable, write for Bulletin GEA-3652. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*


Gas-pressure regulating equipment for gas-filled cable system

GENERAL ELECTRIC

501-28-1200

GAS-FILLED CABLE

Keep on buying BONDS—and keep all you buy

to the supplying power system when breakers are tested to destruction, a complete metal clad switchgear was installed as a back-up. To provide a margin of safety, these should have an interrupting rating of 500,000 kva. but the largest breaker of this type available had a one-second rating of only 80,000 amperes. Since the testing of air breakers would require an interrupting capacity of at least 100,000 amp., it was decided to use one three-pole, 1,200-amp., 250,000-kva. breaker per phase. This resulted in a three-phase interrupting capacity of approximately 500,000 kva. and gave a theoretical one-second rating of 180,000 amp.

The back-up breakers are tripped in a short definite time after the fault is applied with the fault current initiating the timer.

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Outrigged Ladder Has Great Flexibility

Outrigged ladders, widely used on all types of utility structures, have the common fault that the lashings used to fasten them to structural members are often clumsy and sometimes unsafe. Moreover the common ladder is not adapted, from a design standpoint, for the type of loading to which it is subjected in this service.

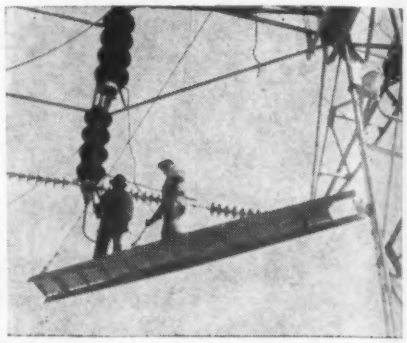
Recognizing these fundamental weaknesses in the catch-as-catch-can use of outrigged ladders, Wisconsin Electric Power Co. construction engineers, perfecting an original idea by Carl Baaska, lineman helper, have designed the universal ladder platform illustrated.

Side members of the special ladder used are two-way tapered struts thickened at the center of their 15-ft. 8-in. length to a thickness of 7½ in. for resistance to bending moments.

A steel support rung at one end of the ladder is fitted with a ½-in. steel plate drilled to mate with two special ladder support brackets; one for attachment to either vertical, horizontal or inclined angles of tower or substation steel work and the other for pole attachment. Holes on the plate attached to the support rung and on the brackets are so spaced with respect to each other that the ladder can be set and locked with thumb screw at virtually any desired horizontal angle. Rope side guys fastened to the outer end of the ladder hold it at any vertical angle that may be desired.

To bind the pole-type support bracket in place a double chain and tightener assembly is used. In the case of the tower-type support bracket a special hook nut and rod arrangement is used to clamp the bracket to both vertical (and inclined) and horizontal structural members.

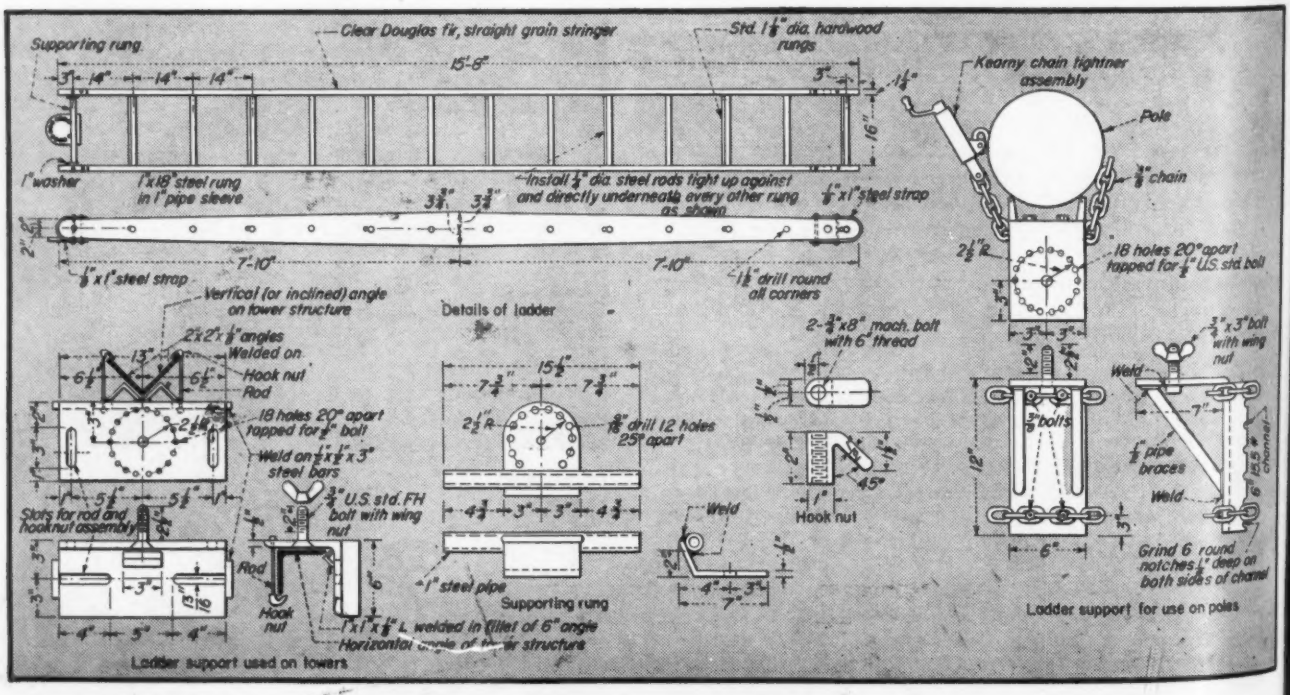
When the platform is used in the horizontal position, as pictured, a 1-in. board, 12 in. wide and 14 ft. long,



OUTRIGGED LADDER specially designed for transmission and substation work can be attached to vertical, inclined or horizontal structural angles as well as wood pole, and can be adjusted to any vertical or horizontal angle that may be desired

is fastened to the ladder, converting it into a convenient platform. When used in a vertical or inclined position, adjustable steps, hooked to the adjacent rungs, give the linemen a firm, comfortable place to stand.

This platform, developed during 1944, has been used on several substation and transmission construction projects and has contributed to the convenience of linemen working in difficult positions.

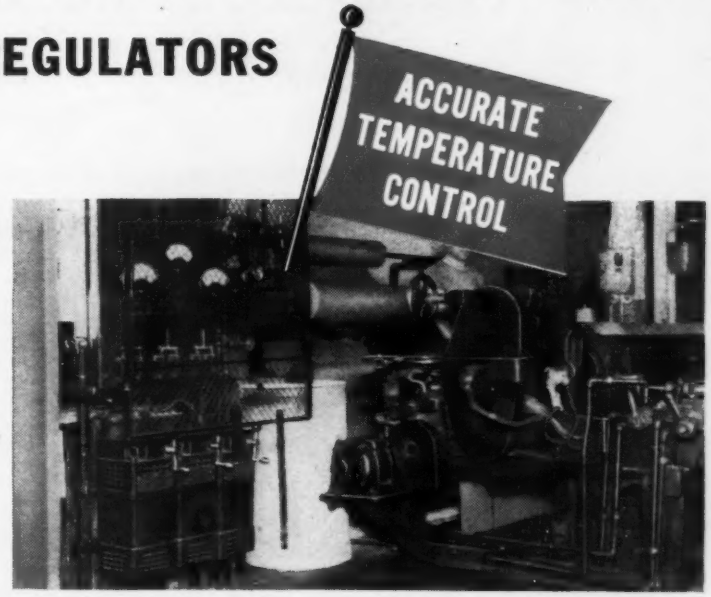


DESIGN DETAILS OF LADDER and support adapters for pole and tower mounting

...PAYS OFF 5 WAYS AT A SINGLE PLANT

USING G-E VOLTAGE REGULATORS

3 Electric heating circuits on a hot-rolling press used to fabricate laminated plastic forms are maintained at the required temperature with induction voltage regulators. Circuits for two electrically heated rollers and one hot plate are separately controlled by the hand-operated regulators, giving close control of processing.



4 Automatic voltage regulation by means of this dry-type induction regulator has "paid off" in a more uniform level of illumination. The full visual value of every kw-hr is obtained with fewer lamp burn-outs from overvoltage. Production space is saved by locating the regulator on a platform along with the Pyranol* transformer which serves the lighting circuits.

*Trade-mark for General Electric's nonsludging insulating and cooling liquid that will not burn

5 This 48-kva Pyranol induction voltage regulator, installed in a basement substation, automatically maintains the proper voltage for lighting circuits in the plant office building. A Pyranol regulator was chosen for its safety in this confined indoor location.

For complete information on any of General Electric's voltage regulation equipment, write for the following publications:

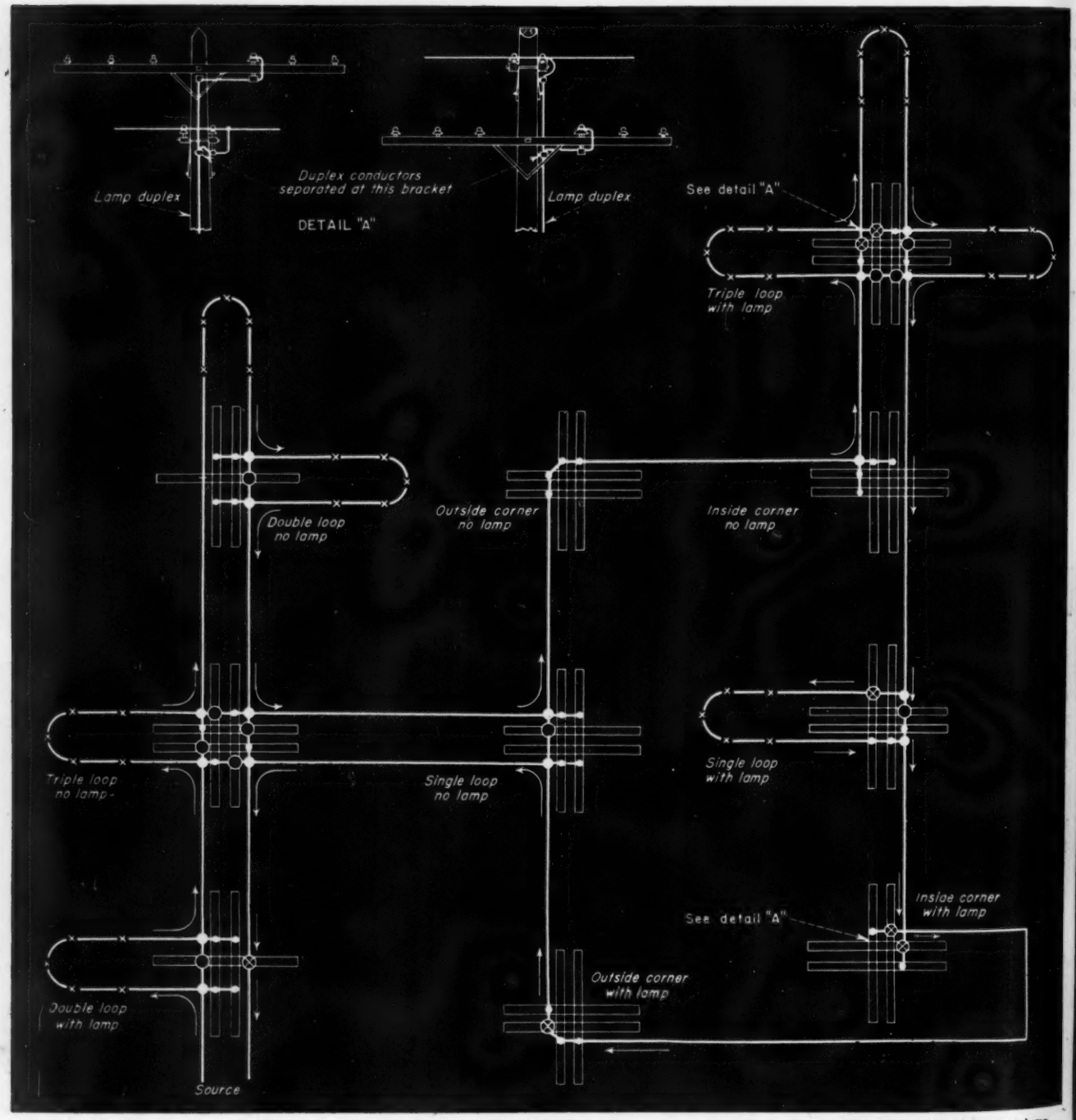
Oil-immersed Induction Voltage Regulators—Type IRS
GEA-2018 (24 kva and smaller)
GEA-2985 (36 kva and larger)
Pyranol Induction Voltage Regulators—Type IRS, GEA-3443
Dry-type Induction Voltage Regulators—Type AIRS, GEA-3057
Inductrols (Small Dry-type Induction Voltage Regulators)
GEP-238
Automatic Voltage Stabilizers GEA-3634
Variable-voltage Autotransformers GEA-3635

GENERAL ELECTRIC

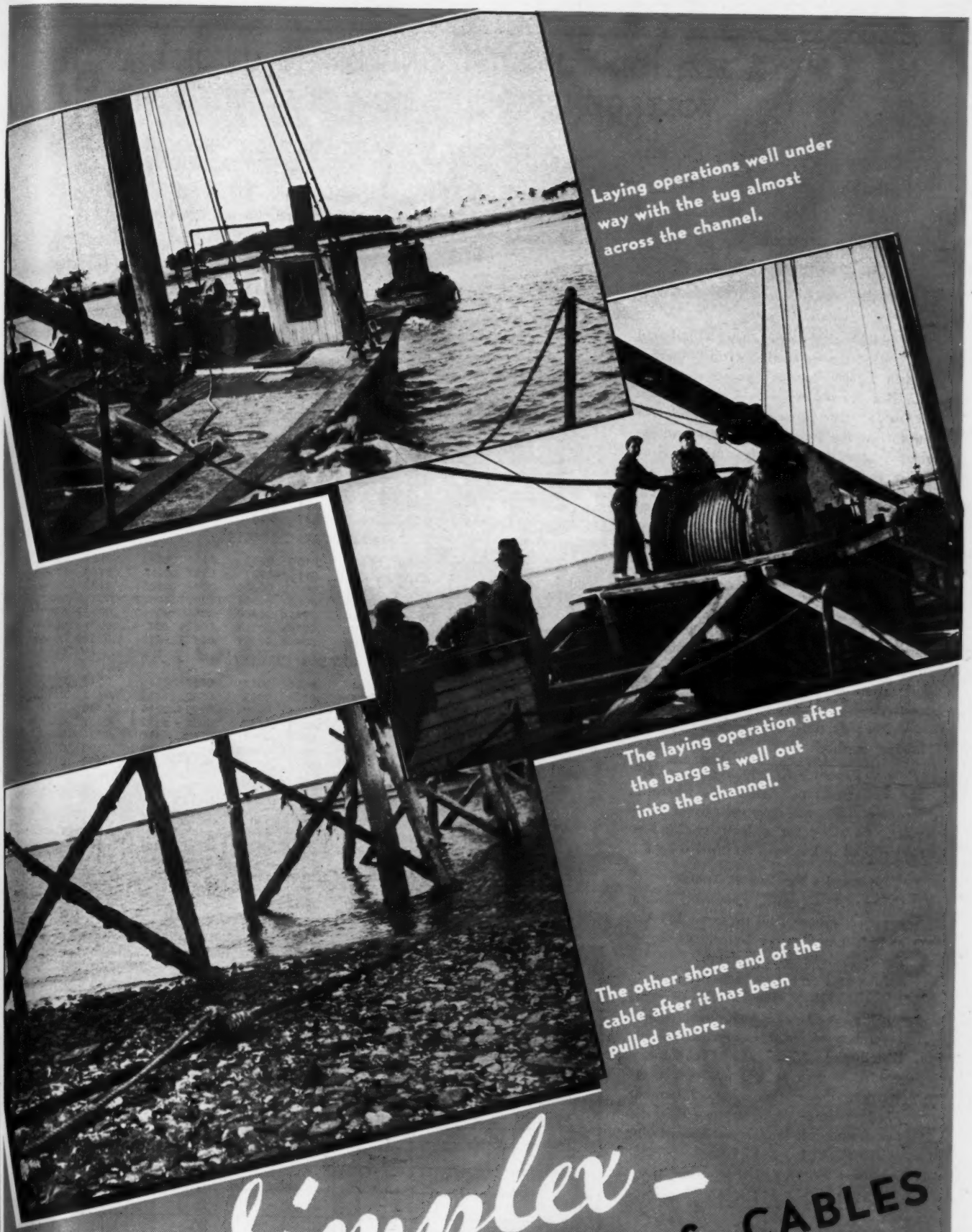
404-38-5400

HOW TO POSITION SERIES LIGHTING WIRE AT CORNERS

Ten examples for running series lighting conductors at corners, having single, double and triple loops with and without lamps. These are standardized practices of the Central Hudson Gas and Electric Corp., Poughkeepsie, N. Y.



● Pin insulator or tie ○ Transposition insulator - double dead end only ⊗ Transposition insulator - tap to lamp



Laying operations well under way with the tug almost across the channel.

The laying operation after the barge is well out into the channel.

The other shore end of the cable after it has been pulled ashore.

Simplex — WIRES & CABLES

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

A METHOD TO DETERMINE DISTRIBUTION VOLTAGE DROP AND POWER LOSS

Calculation table for distribution line operation and a curve of primary voltage drop are adapted from practices of Birmingham (Ala.) Electric Co.

PRIMARY voltage drop curve is designed to be used for determining when to convert a 2,300-volt, single-phase circuit of two No. 6 conductors to 3-phase. From kva.-span value proceed to the conductor curve. At the intersection if the voltage drop exceeds the predetermined drop value then the single-phase circuits are to be changed to three-phase.

Load on the No. 6 conductor should be limited to its maximum current carrying capacity as follows:

No. 6 Cond.	Summer	Winter
Bare	100 amp.	135 amp.
Weatherproof	110 amp.	160 amp.

Under all circumstances the unbalanced condition of the feeder and the distance of the single-phase tap from the substation should be taken into consideration.

Voltage drop is calculated by the following method:

$E_1 = \sqrt{(E_2 \cos\theta + RI)^2 + (E_2 \sin\theta + XI)^2}$

and Voltage drop $= E_1 - E_2$, where E_2 represents the receiver voltage of 2,300 volts. To allow for a diversity the connected load in kva. was multiplied by 0.7.

Examples for Use of Tables

1. *Given:* A 3½-mile, 4,000-volt, No. 6 copper, 3-phase line to serve 100 kw. at 85 percent power factor.
   Find: Percent voltage drop.
   Solution: Percent voltage drop $=$ $3.5 \times 0.0158 \times 100 = 5.53$ percent.
2. *Given:* A 110/220-volt, single-phase secondary of No. 2 copper. Loads are distributed—2.5 kw. at 200 ft., 4 kw. at 400 ft., 3 kw. at 600 ft. from transformer. Power factor is 100 percent.
   Find: Voltage drop at the 600-ft. distance when all load is on, considering load balanced.
   Solution: Percent voltage drop $=$

$$\frac{200 \times 2 \times 1.74 \times 2.5}{5280} + \frac{400 \times 2 \times 1.74 \times 4}{5280} + \frac{600 \times 2 \times 1.74 \times 3}{5280} =$$

$0.33 + 1.055 + 1.186 = 2.571$ percent

Calculations for power loss are similar by substituting power loss constant.

PERCENT VOLTAGE DROP AND POWER LOSS PER KW.-MILE FOR COPPER CONDUCTOR

(except for 13,200-volt circuit which is "per 100 kw.-mile")
Values for calculations on 3-phase circuits;
for single-phase circuits, multiply by 2

220-VOLT CIRCUITS

Cond. Size	P.F. 100% V.D.	P.L.	P.F. 90% V.D.	P.L.	P.F. 80% V.D.	P.L.	P.F. 70% V.D.	P.L.	P.F. 60% V.D.	P.L.
6	4.34	4.28	5.02	5.28	5.42	6.68	5.80	8.17	6.19	9.70
4	2.74	2.69	3.40	3.32	3.79	4.20	4.18	5.17	4.57	6.13
2	1.74	1.69	2.37	2.09	2.74	2.64	3.12	3.39	3.49	4.45
1/0	1.10	1.06	1.71	1.31	2.07	1.66	2.38	2.11	2.72	2.68
2/0	0.82	0.84	1 48	1.04	1.83	1.32	2.19	1.67	2.54	2.09
3/0	0.70	0.67	1.29	0.83	1.63	1.04	1.98	1.33	2.34	1.69
4/0	0.56	0.53	1.14	0.65	1.47	0.83	1.78	1.06	2.13	1.34

440-VOLT CIRCUITS

6	1.08	1.07	1.25	1.32	1.35	1.67	1.43	2.04	1.52	2.41
4	0.68	0.67	0.85	0.83	0.95	1.05	1.05	1.30	1.16	1.54
2	0.43	0.42	0.59	0.52	0.68	0.66	0.76	0.84	0.84	1.10
1/0	0.27	0.26	0.43	0.33	0.52	0.41	0.61	0.51	0.70	0.62
2/0	0.20	0.21	0.37	0.26	0.46	0.33	0.56	0.43	0.66	0.55
3/0	0.17	0.17	0.32	0.21	0.41	0.25	0.52	0.30	0.62	0.36
4/0	0.14	0.13	0.28	0.16	0.37	0.20	0.45	0.25	0.53	0.30

4,000-VOLT CIRCUITS

6	.0132	.0137	.0152	.0162	.0164	.0203	.0177	.0247	.0189	.0290
4	.00831	.00817	.0103	.0101	.0115	.0127	.0127	.0154	.0140	.0181
2	.00526	.00514	.0072	.00635	.00832	.00802	.0094	.0105	.0105	.0148
1/0	.00335	.00324	.00525	.00400	.00627	.00505	.00722	.00648	.00823	.00833
2/0	.00250	.00249	.00445	.00316	.00554	.00400	.00648	.00503	.00739	.0062
3/0	.00213	.00203	.00392	.00251	.00495	.00317	.00602	.00374	.0071	.00448
4/0	.00171	.00161	.00348	.00198	.00446	.00251	.00547	.0033	.00649	.00425

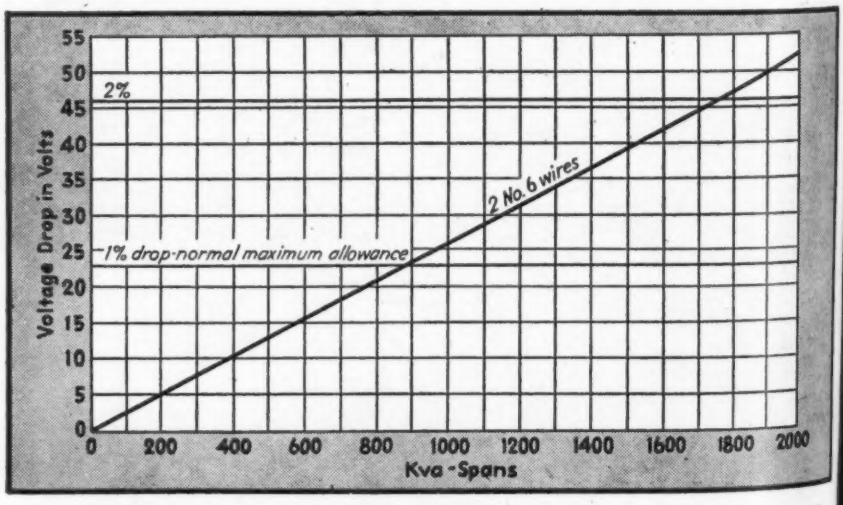
2,300-VOLT CIRCUITS

6	.0398	.0392	.0460	.0484	.0496	.0612	.0537	.0770	.0578	.0975
4	.0251	.0246	.0311	.0304	.0346	.0385	.0380	.0483	.0412	.0612
2	.0159	.0155	.0217	.0191	.0251	.0242	.0292	.0315	.0332	.0398
1/0	.0101	.0098	.0157	.0120	.0189	.0152	.0225	.0192	.0261	.0235
2/0	.0075	.0077	.0135	.0095	.0167	.0121	.0200	.0160	.0231	.0200
3/0	.0064	.0061	.0118	.0076	.0149	.00956	.0170	.0112	.0190	.0140
4/0	.0052	.0049	.0104	.0060	.0134	.00760	.0157	.0092	.0182	.0115

13,200-VOLT CIRCUITS

(Percent Voltage Drop and Power Loss per 100 kw.- Mile)

6	.119	.119	.140	.147	.151	.188	.164	.236	.177	.286
4	.0745	.0745	.0947	.0927	.106	.116	.118	.144	.131	.180
2	.0471	.0471	.0665	.0581	.0774	.0735	.0880	.0921	.0982	.117
1/0	.0298	.0298	.0483	.0363	.0584	.0460	.0698	.0580	.0802	.070
2/0	.0234	.0234	.0416	.0288	.0524	.0365	.0638	.0450	.0744	.0542
3/0	.0186	.0186	.0358	.0230	.0462	.0288	.0563	.0360	.0671	.0442
4/0	.0147	.0147	.0321	.0168	.0417	.0232	.0498	.0302	.0582	.0402



Curve shows percent of primary voltage drop per kva.—span on 2-wire, No. 6 conductor, 2,300-volt, 60-cycle, single-phase circuit; 97 percent pure copper wire at 25 deg. C.; 85 percent power factor; 44½-in. spacing; based on 100-ft. spans

An Automatic Line Splice that holds fast — reduces work hazards — saves time

Four-jaw serrated gripping unit of Fargo Splice holds solid and stranded wires in permanent, slip-proof grip.

1. Whole jaw assembly is made from one piece of metal, so teeth automatically keep in alignment; the whole unit is stronger.

Four-jaw construction adjusts better to the contour of conductor; jaws grip from end of wire outward with pulling strain distributed along the wire—not located at one point.

Uniform height and spacing of teeth assures maximum conductivity and sure gripping.

2. Spring is made of phosphor bronze for long life and high fatigue point; exerts ample pressure to prevent the conductor from working out of the jaw when the splice is not under tension.

3. Stop plate made of heavy copper—prohibits wire from becoming tangled with spring.

4. Safety zone accommodates burred and upset wire ends.

High conductivity—dependable service

All external and internal parts of the Fargo Line Splice are weather and corrosion resistant. This, with the other features of sturdy construction shown above, adds up to an Automatic Line Splice that holds fast — even under alternating tension and slack occasioned by whipping wind action.

Thus, the Fargo Splice can be used over and over again.

Reduces working hazards

With no crimping tools needed to install the Fargo Automatic Line Splice, the safety factor is materially improved when working in dangerous high voltage zones. Even when working on dead lines, the lineman is less likely to be in danger if he needs no extra tools; has both hands free to make the splice.

Simple, Quick Release

The Splice will hold the conductor in permanent, slip-proof grip, but it's simple to release the wire when necessary. Pushing in on the wire forces the jaws and spring back so that a screw driver can be inserted through the "disengage" slot. This holds the spring back and the jaws open so that the wire can be withdrawn.

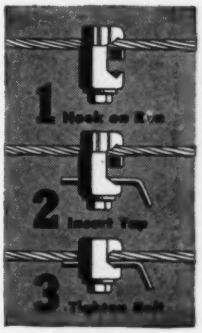
Saves time

The features which make the Fargo Automatic Line Splice safer to use also reduce the amount of time needed to do the job. In addition, the Fargo Automatic Line Splice has guide lines around the body which designate where the ends of the conductor will be after the Splice is installed and tension applied. As a result, the lineman knows in advance how much sag the line will have when the wire ends are properly inserted in the Splice. It saves time in estimating the length to which the conductor should be cut. (See below.)

Fargo Automatic Line Splices are made to handle wire sizes from 6 Solid to 4/0 Strand. Reducing Splices used to connect smaller wires to larger ones, are also available. See listing of Fargo products in Electrical Buyers Reference.

Every Fargo Automatic Line Splice is hand tested before it leaves the factory!

One-piece vise-type connectors save man hours—reduce service interruptions



Fargo solderless connectors are easy and safe to handle, permanently vibration-proof and produce high conductivity at contact point.

Fargo connectors available in sizes No. 8 to 1,000,000 CM

"Grips like a vise"

(Approved by Underwriters Laboratories, Inc.)

FARGO MFG. COMPANY

ESTABLISHED 1914

POUGHKEEPSIE, NEW YORK

Full Fargo Line Distributed by
LINE MATERIAL COMPANY
Milwaukee, Wisconsin.
(Representatives in principal cities)

SOLDERLESS CONNECTORS • LINE SPLICES • ELECTRICAL SPECIALTIES

ILLUMINATION FROM A LINE SOURCE

HARRIS REINHARDT, Commercial Engineering Dept.,
Sylvania Electric Products, Inc., Danvers, Mass.

The well known inverse square law which states that the illumination produced by a point source varies inversely as the square of the distance from the source has enjoyed a wide popularity in lighting circles, because of the fact that many light sources are sufficiently close approximations to point sources to make this a convenient means of visualizing and estimating the illumination produced by such sources.

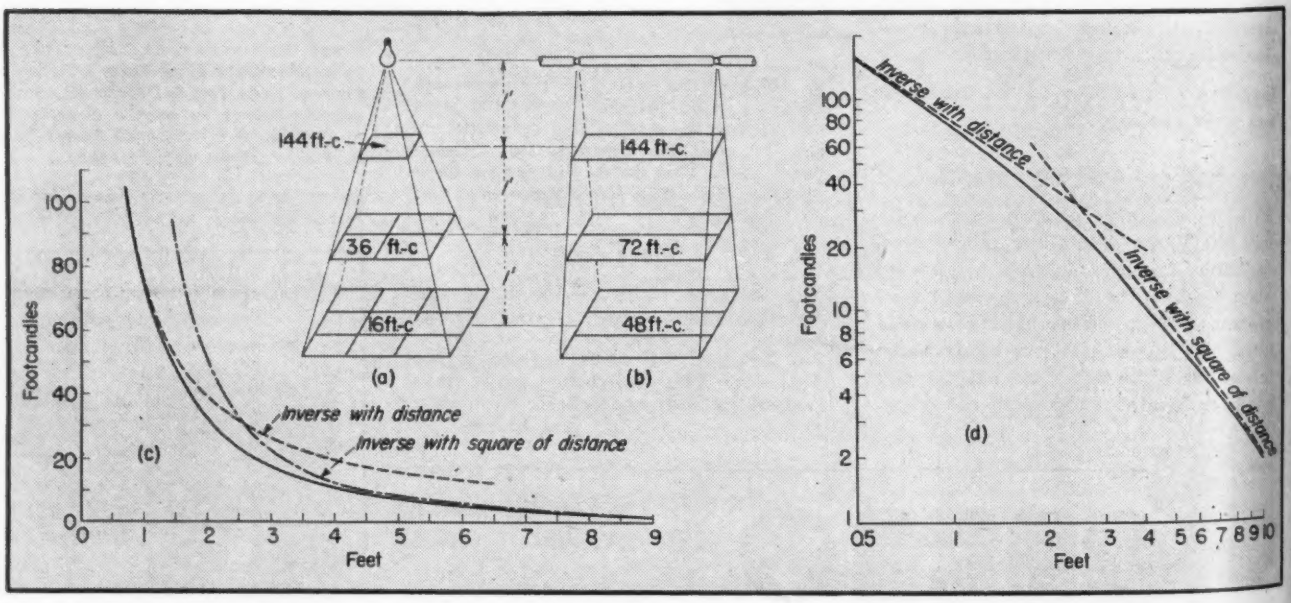
The introduction and extensive use of fluorescent lamps has awakened an interest in the laws concerning the variation of the illumination produced by line sources. In the case of a line source of infinite length, the illumination on a plane parallel to the source varies inversely with the distance from the source. This might be referred to as the inverse distance law for a line source.

The inverse square law and the inverse distance law are illustrated in the accompanying diagrams. The diagram for the inverse square law shows how the rays from a point source spread out in the form of a pyramid (actually a section of a sphere). The area which might be lighted by the lumens within the pyramid is proportional to the square of the distance from the source and the illumination in footcandles (lumens per square foot) therefore varies inversely with the square of this distance. With a continuous line source the rays tend to spread out in the form of a wedge (actually a section of a cylinder), so that the area which must be lighted by the lumens within the wedge is proportional to the distance from the source, and the illumination thus varies inversely with the distance from the source.

For a source of finite length the illumination follows a somewhat more complex relationship which depends upon the actual candlepower distribution of the source. Such equations usually involve inverse trigonometric functions as well as algebraic expressions and therefore are not readily visualized.

In order to illustrate this seemingly complex relationship of the inverse distance and the inverse square laws, the illumination produced at various distances directly beneath the center of a line source 4 ft. in length, having a so-called perfectly diffusing type of candlepower distribution and an apparent candlepower of 50 candles per ft., is shown on the accompanying graphs, on uniform and logarithmic scales. From these graphs it can be seen that the illumination from the line source approaches the inverse distance law for distances very close to the lamp, whereas it approaches the inverse square law for distances which are of the order of twice the length of the lamp or greater than that length.

On the log graph the inverse square law and the inverse distance law appear as straight lines whereas the illumination from the 4-ft. line source appears as a curve which approaches the two lines at both ends. The value of a graph of this type lies in the fact that it is a relatively simple matter to calculate the few points necessary to establish the straight lines, and thus obtain an accurate picture of the limiting conditions on the illumination from any particular source without having to go through the laborious task of substituting in an elaborate equation.



Light from point source (a) varies inversely as square of distance (inverse square law) while from continuous line source (b) variation is in simple inverse relationship (inverse distance law). Inverse square and inverse distance laws combine to determine light from line source of finite length. Data of illumination from a 4-ft. line source of 50 apparent candlepower per ft. plotted on uniform scale (c) and on logarithmic scale (d)

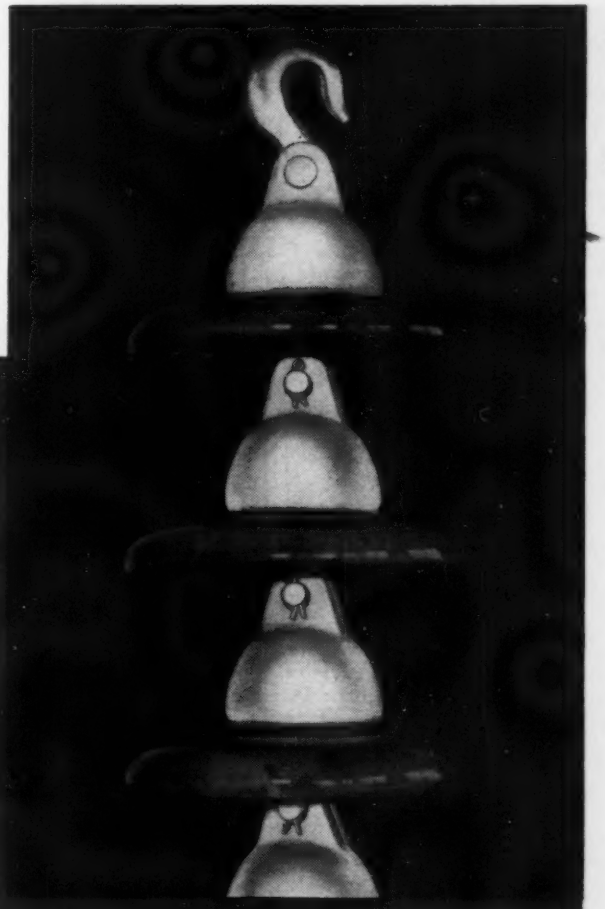
BTC STANDARD DROP FORGED FITTINGS

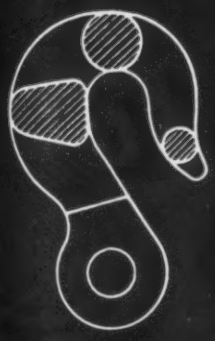
or Dead-End Insulator Strings

The photograph and blue prints shown below illustrate standard B.T.C. fittings for Clevis Type insulators. Similar drop forged fittings for the support of arcing horns are available. There are B.T.C. standard clamps and fittings to build the complete line; special designs made for unusual conditions.

THE BREWER-TITCHENER CORPORATION
CORTLAND, N. Y.

CLEVIS TYPE





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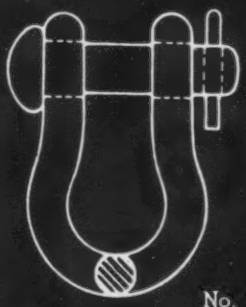

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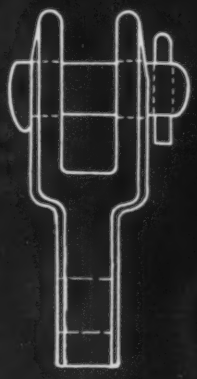
BTC DROP-FORGED Hi-Line HARDWARE



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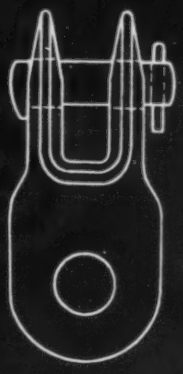
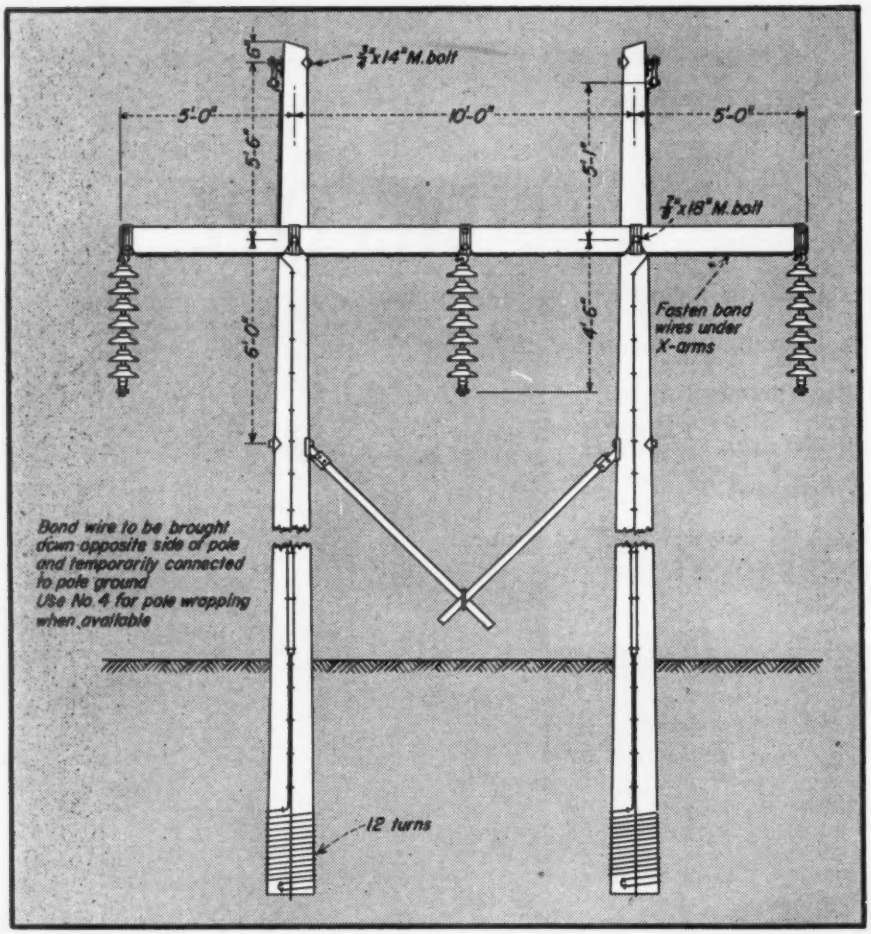


No. 3061

Bonding, Grounding Eliminate Excessive Static

E. H. AIKEN*
Chief Electrical Engineer
Imperial Irrigation District, El Centro, Calif.



STATIC WIRE AND LINE HARDWARE are separately grounded on 92-kv. line built by Imperial Irrigation District. Shown is a standard H-frame structure with some of the grounding details. Bond wire and ground wire are on opposite sides of poles

Separate grounding of static wires and pole line hardware on transmission lines of the Imperial Irrigation District has largely solved an unusual static condition in the Imperial Valley of southern California. Where humidity runs as low as 7 percent over a relatively long period, as it does here, electrostatic charges often build up to such an extent that one can draw a spark ½ to 1 in. long from the door of an automobile.

During late summer, after temperatures have ranged high for some time and moisture has been driven from the wood, these static charges build up quite readily on all isolated metal parts of power lines. Pins, phase assemblies, and intermediate caps on strain insulators take on a high charge and begin collecting dust particles, much in the same way a Cottrell precipitator operates in cleaning air or gases. Along dusty roads and canal banks, where the wind whips up dust, these metal parts and the sections of the insulators near them become "frosty" with fine dust particles, which stick on in the same manner that iron filings stick to a magnet.

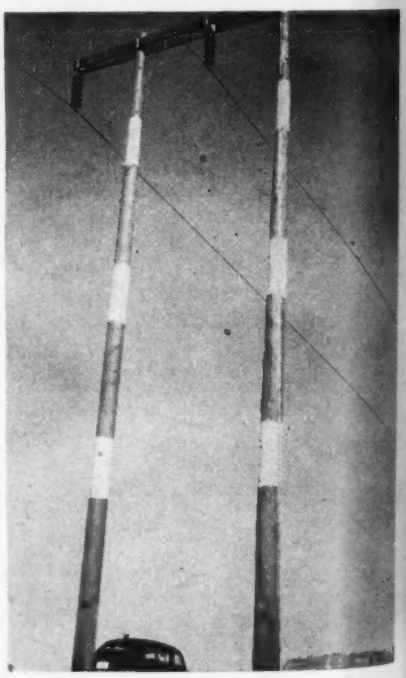
Around the middle of September a heavy fog usually pours in from the Gulf of California and blankets the south end of the valley. This is so heavy that everything drips excessively. As this moisture collects on the insulators and mixes with the dust particles, the insulators begin to leak and flash over. The crossarms and poles are saturated on the outside, but are still kindle-dry inside. The leakage upon jumping the gap between the crossarm and pole ignites the wood in the gain. After once starting, the flame soon burns off the top of the pole and the crossarm.

After some experimenting and study, it was found that by bonding, and preferably by bonding and grounding all hardware, the electrostatic charges were prevented from building up and the trouble was very materially reduced. In fact, after four years of operation, after bonding, the only failures that have occurred have been caused by broken insulators. Prior to bonding only 30 days were required to build up a deposit on new, clean insulators to the point where the fog caused them to leak sufficiently to set fire to the pole.

On a new 92-kv. line recently completed, all hardware is bonded and grounded separately from the static wire. To compensate for the loss of the insulating value of the crossarm and pole, which obviously cannot be made use of anyway, seven 10-in. O.B. No. 34500 suspension insulators are used on all vertical, and eight on all horizontal strings.

All hardware is bonded and grounded separately at each structure with the ground wire down one pole, isolated from and on the side of the

White Striping of Poles



GOOD CONTRAST and visibility is obtained by Bonneville Power Administration by the more or less conventional white striping of transmission poles. Long sections of many miles of line near airports and on air routes in central Washington state are so marked

* Now Service Shop Engineer, General Electric Co., Los Angeles.

A New Idea

DEVELOPED BY

Westinghouse

THE Select-o-ray

Sun Lamp *and* Heat Lamp combined in one attractive fixture

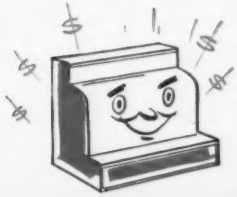
It's new . . . it's exciting!

It's both a Sun Lamp and a Heat Lamp . . . either of which can be used independently of the other. For the first time, *either* sun tanning ultra-violet rays or penetrating infrared heat rays are available . . . in one convenient unit . . . at the flip of a switch. Never before has either a Sun Lamp or a Heat Lamp offered such efficiency and convenience as that which is *combined* in Select-o-ray.

It features the new Westinghouse RS Sun Lamp and Red Heat Ray Lamp

The new RS Sun Lamp and Red Heat Ray Lamp were developed by Westinghouse. Each Lamp is a self-contained unit requiring no transformer . . . and having a built-in reflector which retains its full brightness for the life of the Lamp. The Sun Lamp has three times the sun tanning power of July sunlight. The Red Heat Ray Lamp is made of special glass which will not break if splattered with water when lighted.

It's priced for action!



Retails for about one-half the price of a pre-war Sun Lamp fixture alone. Popular price, easily demonstrated features and ready acceptance of the name Westinghouse, puts retailers in line for volume sales of this exciting new home appliance.

J-04078

EASILY CONVERTED INTO TABLE MODEL

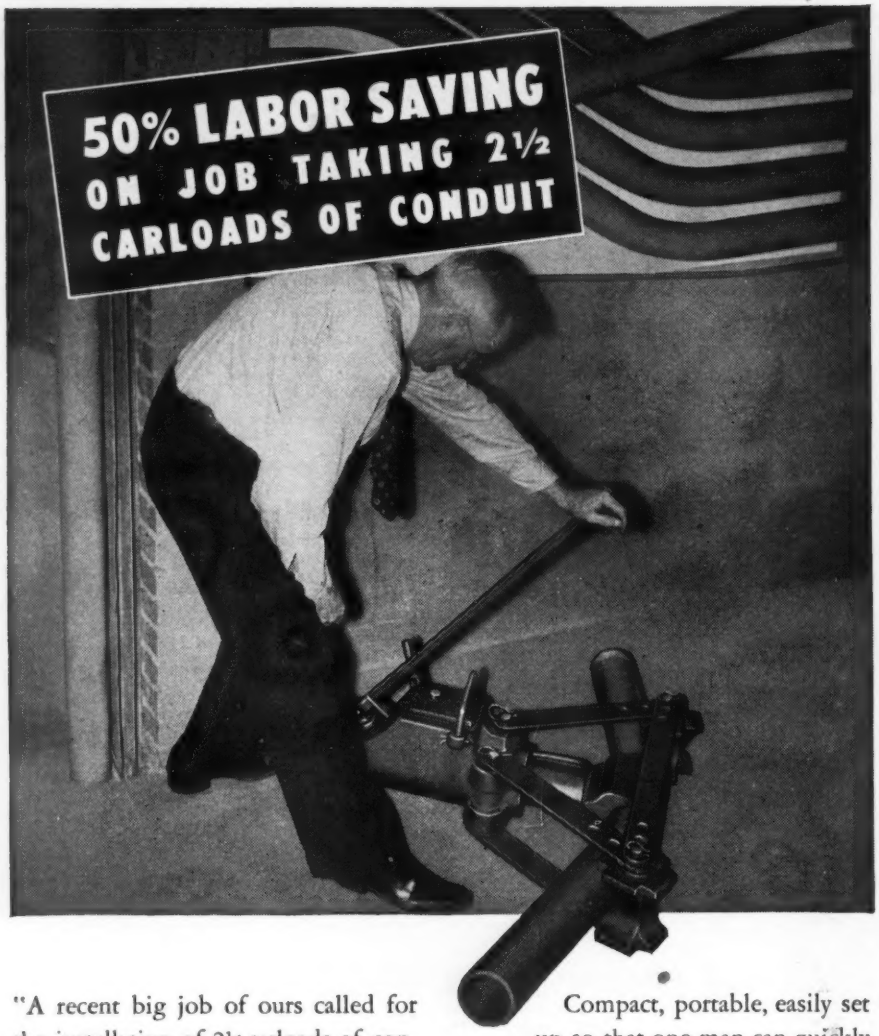
The top assembly may be quickly and easily removed from the floor standard by turning it counterclockwise, while holding the slim adjustable tubing stationary. A wide, sturdy base, permanently attached to the top assembly affords ample support.

it's an exclusive product of

Westinghouse

Maker of 30 MILLION Electric Home Appliances

Tune in **John Charles Thomas,** Sunday 2:30 EST., N.B.C. . Hear **Ted Malone,** Monday through Friday, 11:45 A.M., EST., American Broadcasting Company



"A recent big job of ours called for the installation of 2½ carloads of conduit in various sizes. All of this was bent with a GREENLEE Hydraulic Bender and we saved at least 50% in labor hours and 10% on fittings and manufactured bends."

"This is typical of our several years' experience with a GREENLEE," reports Harry C. Korns, owner of Harry C. Korns Electric Co., St. Joseph, Mo.

You, too, can speed installations with a GREENLEE Bender... and savings made on one job such as above will more than pay for it!

Compact, portable, easily set up so that one man can quickly bend pipe up to 4½", rigid and *thin-wall* conduit, tubing, bus-bars . . . right on the job!

Whatever your bending needs, there is a GREENLEE to do the work. For complete information on GREENLEE Hydraulic and Hand Benders and other timesaving tools get free Catalog 33E. Greenlee Tool Co., Division of Greenlee Bros. & Co., 1812 Columbia Avenue, Rockford, Illinois.

REGISTERED TOOLS
GREENLEE
FOR THE CRAFTSMAN

OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK
Hand Benders • Joist Borers • Cable Pullers • Knockout Tools • Pipe Pushers

pole opposite the static wire ground. The static wires are grounded separately at each structure, but are not tied together at the tops of the poles. All poles are butt-wrapped with No. 4 solid copper to provide grounding. It is planned to install ground rods at a later date, when materials become more readily available. The accompanying drawing shows a standard tangent structure with some of the details of the grounding referred to.

•

Solar Energy Derived from 30-ft. Mirror

Experimentation in Russia with mirrors to concentrate solar radiation energy has progressed to the point of using a 10-meter-diameter paraboloid mirror. The arrangement is being tried out at a Tashkent cannery under industrial conditions.

Reflector surfaces consist of "ordinary window glass bent into the desired shape without pre-heating." The mirror is carried by a light framework which revolves to follow the sun.

Early tests in 1941 at Stalinabad had succeeded in melting iron and other metals. The experimenter is a Spaniard, Federico Molero.

•

Surge Current Duty, Size of Equipment

CONRAD A. SEDERLUND
Consulting Engineer, Hoxsie, R. I.

There has been an appreciable tendency, when installing equipment of sufficient interrupting capacity, to neglect the effect of surge currents on disconnects, cable, potheads, and such equipment which is not determined by interrupting capacity. It will be well to consider the probable behavior of these devices in cases where large surge currents would occur during short circuits.

The temperature and magnetic forces that occur during surge currents can be figured quite closely, but it may well prove that analysis of the phenomena and of the available information on this subject will show the need of more test data in this field during periods which breakers and fuses require before clearing faults.

If the short-circuit duty on a sys-

Frigidaire's Fifteen Fundamentals

A Realistic Program to obtain greatly expanded volume for both Field and Factory

1. Give major attention to all kinds of refrigeration products for which a volume market now exists or can be developed.

2. Devote intensive effort to the important electric range and water heater business.

3. Add new products that logically complement our present line, and where we can contribute important improvements.

4. Continually seek ways to improve all Frigidaire products to keep them first in quality, utility and appearance.

5. Price all products competitively, quality and service considered.

6. See to it that Frigidaire merchandising plans, sales helps and advertising are outstanding and always reflect the high ethical standards under which we operate.

7. Give the best service of anyone in our industry.

8. Have in each market the proper number of quality dealers to obtain Frigidaire's proper share of available volume, and at the same time to provide a profitable potential for each Frigidaire dealer and his salesmen.

9. Help potentially good dealers develop into real quality dealers—wherever feasible build instead of change dealers.

10. Give full recognition to the important way in which our success and that of our dealers depend upon the Retail Supervisor, Salesman and Serviceman.

11. Do the best training job in our industry on both sales and service.

12. In every way, keep as our goal the building of even greater dealer and customer good will.

13. Try to enhance and improve our reputation for integrity. Resolve that more and more the name Frigidaire shall stand for honest, sincere and capable handling of all situations.

14. Keep an open mind and really try to find out and provide what the public and field organization want.

15. Recognize more than ever the importance of Teamwork between all members of our organization—all Factory and Distributing Personnel, Dealers, Supervisors and Salesmen, Servicing organizations and Servicemen.

FRIGIDAIRE DIVISION • GENERAL MOTORS CORPORATION

There is no more trustworthy path to achievement than a code of sound principles sincerely conceived and courageously followed—such as these Fifteen Fundamentals to which I wholeheartedly subscribe.

WE INVITE YOU TO READ THESE "FIFTEEN FUNDAMENTALS" carefully. They tell—in a few words—why the Frigidaire franchise is held in such high regard throughout the appliance industry. Frigidaire Division of General Motors—Dayton 1, Ohio; Leaside 12, Ontario.

The resultant damage from a fire in this pumping station must be calculated, not only in terms of actual physical loss but also in terms of losses resulting from the interruption to plant operations.

Whether started from a cracked fitting, faulty pump packing, leaky flange or similar cause—fires of this type have sent flames rocketing to alarming proportions and intensity within the space of a moment.

Matching the speed and ferocity of the fire, with the instant starting and control obtained, "Automatic" FIRE-FOG offers the modern effective means of combating this serious threat to plant operations.

There's no escaping FIRE-FOG's mist-fine water spray—it beats down the flames, drives out the oxygen, smothers the fire.

Automatic in operation and supersensitive to quick heat rises, FIRE-FOG is ideal for quenching fires of flammable liquid origin —positive protection for such areas as loading racks, valve pits, process building and areas, oil filled electrical equipment and similar hazards.

"Automatic" Sprinkler

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA

YOUNGSTOWN, OHIO . . . . . OFFICES IN 36 CITIES

"Automatic" Sprinkler manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Listed by Underwriters' Laboratories, Inc., and approved by Factory Mutual Laboratories.

tem is high and transformer banks are small, the size of all equipment should be governed by surge current duty and not by the capacity of the transformer banks as has been done at several places.

Following is a brief outline of equipment that should be considered in such cases:

Porcelain Disconnects

When using porcelain enclosed fuse cutouts with solid blades as disconnecting switches, it is well to be careful of surge currents that will occur during short circuits.

A fuse cutout, changed to a disconnect by installing a solid blade, or a standard commercial small-size porcelain enclosed disconnect, may take cable up to No. 3/0. If 8-cycle breakers are used in this circuit, No. 1 cable will stand approximately 14,000 amp. for 8 cycles on a 60-cycle system without injury to varnish cambric insulation, and will stand approximately 25,000 amp. before fusing. Manufacturers will not guarantee these disconnects for more than the NEMA. standard rating which is usually 1,500 amp. for 5 sec. and 2,500 amp. for 1 sec. Manufacturers have stated that during high currents on these disconnects the contacts will hum or the switch fly open.

If the short-circuit current on a system is high, these switches would fly open, holding the arc until the oil circuit breaker opened. Several dangers would exist with such a condition. Actual tests for surge capacity of these switches will, no doubt, be made when manpower is available and the war rush is over.

Determining Size of Cable

Where a small transformer bank is used on a system it may be that, for example, No. 6 cable is sufficiently large for that size of transformer bank, but if 8-cycle breakers are to be used and the short circuit can reach 7,000 rms. amperes, it would be necessary to install No. 2 varnish cambric cable to prevent charring of the insulation during a short circuit. Fusing current should not be used for determining the cable size. Charts are available giving the maximum current that cables can withstand for short periods without injury to the insulation.

Information from pothead manufacturers states that short-time rating of their equipment is not available.

Because of their dual operating characteristics

TYPE "H" KYLE AUTOMATIC Oil Circuit Reclosers will increase your revenue

Kyle Automatic Oil Circuit Reclosers at strategic points on your lines can be counted on to isolate permanent faults to the shortest possible branches . . . keep the revenue producing current going to the main lines and all unaffected branches.

These dual operating characteristics, as exemplified in the Type "H" Kyle Automatic Oil Circuit Recloser, provide:

1. *Fast Opening* of the Recloser on the *First* and *Second* Operations.
2. *Time Delay Opening* of the Recloser on the *Third* and *Fourth* Operations.

Only a Kyle Automatic Oil Circuit Recloser with these dual operating characteristics will clear all temporary faults and also permit the use of additional sectionalizing devices to isolate permanent line faults.

Advantages of Dual Operating Characteristics

1. All temporary line faults, which comprise 90% of line disturbances are cleared AUTOMATICALLY.
2. Service continuity is increased with resultant higher revenue and better customer satisfaction.
3. Outages are confined to the smallest possible area.

Ask your Line Material Representative to furnish you with complete details on the Type "H" Kyle Automatic Circuit Recloser and how it can be used most effectively to protect your system.

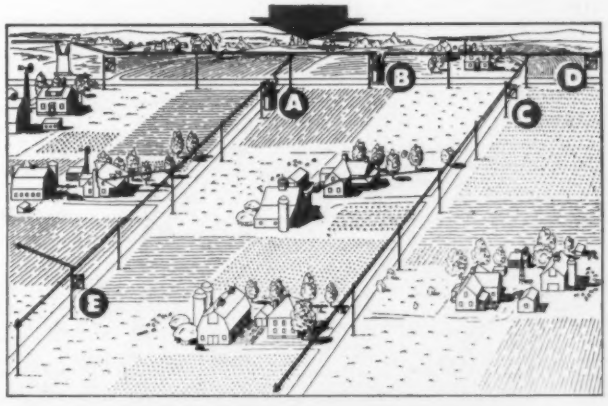
RECLOSER RATINGS: Volts—2400 to 15,000; Amperes—5 to 50; Tripping Current—10 to 100 Amperes; Interrupting Current—150 to 1200 Amperes.

HERE'S HOW IT WORKS:

To protect branch lines from a substation feeder, Kyle Reclosers are located at "A" and "B" to isolate the branches from the main line. Fuses are used on the load side of the Kyle Recloser at "C", "D", and "E" to sectionalize the branch line.

If a fault beyond the sectionalizing fuses is not cleared on the first two operations of the Recloser, it is considered of a permanent nature and the branch line should be isolated by the blowing of the sectionalizing fuse. The Type "H" Kyle Automatic Circuit Recloser permits coordination with the sectionalizing fuse on its third and fourth operations, so that the fuse is blown before the Recloser locks out.

In this way, the line outage is confined to a small portion of the protected system and service is maintained to the remainder of the system.

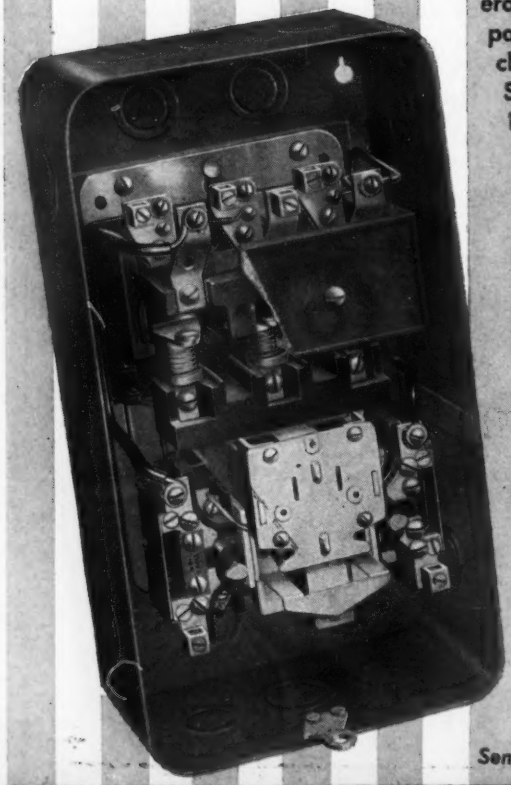


MADE BY KYLE CORPORATION SOUTH MILWAUKEE WISCONSIN

KYLE Circuit Breakers are Designed and Manufactured for LINE MATERIAL COMPANY MILWAUKEE WISCONSIN

Federal's Noark Magnetic Starter
Is completely different and plenty smarter
Equipped with action that's ball-bearing
For safe control and longer wearing

Federal NOARK
Magnetic Motor Starters



There's only one moving part in Federal Noark Controls . . . and that part rolls on ball bearings—an exclusive Federal feature! Result? Smooth, faster making and breaking of contact, accurate action . . . less friction . . . longer life. Here are more reasons for specifying Federal starters:

- Double break pure silver contacts held by a single screw for ready replacement.
- Heavy arc barriers located for strength, flashover resistance, high arc rupturing.
- Molded parts have asbestos base with non-carbonizing inorganic binder.
- Coils readily changeable—just remove retainer spring, loosen yoke, take out magnet.
- Overload relays—*combination hand and automatic reset.* Bimetalic type. Originated by Federal.
- Heaters frontmounted, accessible; trip ampere stamped on units.

Send for your copy of the FEDERALOG.

FEDERAL ELECTRIC PRODUCTS COMPANY, INC.
EXECUTIVE OFFICES: 50 PARIS ST., NEWARK 5, N. J. · PLANTS: HARTFORD, CONN. · NEWARK, N. J.

although calculations can be made with reasonable precision. It should be pointed out that for smaller conductor sizes in potheads the maximum current which a terminal can withstand may be limited by the value of the current which can be applied to the cable entering the terminal. If excess currents are developed in potheads, sufficient heat may be generated in small cable to melt the lead-tin eutectic at the soldered lugs. If this occurs the resistance of the soldered lugs, etc., may be increased sufficiently to give trouble either at the time of the short circuit or at some later date.

•

Let Water Out of Tubular Risers

A ¼-in. hole drilled at a low point in pockets formed by crimped tubular copper risers and leads in outdoor substations will allow accumulated water to drain out before it can freeze and bulge or crack the tube. Similarly holes at the base of pipe-type fence posts, which are open at the top, are a wise precaution practiced by the Northern Indiana Public Service Co., Hammond.

•

Army-Type Car for Patrol

ARMY-TYPE reconnaissance car being used by the production and transmission department of Utah Power & Light Co. for patrolling high tension lines and in line construction. Transmission department men are so enthusiastic over this four-wheel-drive vehicle that they intend to purchase more of them as soon as they are released by the Army

TURN ON THE HEAT

when and where you want it...

...with NICHROME*

In addition to toasters, electric irons, radiant heaters, stoves, etc., the uses for electrical heating elements have multiplied into an almost endless list of new and novel applications during the war.

From keeping aerial cameras warm in the stratosphere to protecting delicate roots underground, Nichrome heating elements have been impressed into service to deliver dependable heat . . . *wherever* and *whenever* it is required.

In all of these applications the vital factor of dependability leaves no room for compromise with quality. For this reason and because Nichrome insures long heater life and close control over wide temperature range, it has been specified for *more new electrical heating applications than any other alloy resistance wire.*

Although there are several excellent Nickel-Chromium combinations there *is only one* NICHROME and it is *made only by* Driver-Harris. For improved performance and longer life in your new products, specify Nichrome and other resistance alloys by Driver-Harris. Tell us what you need.

*Trade Mark Reg. U. S. Pat. Off.

NICHROME
is made *only* by

SPECIAL PURPOSE ALLOYS SINCE 1905

Driver-Harris
COMPANY
HARRISON, N. J.

BRANCHES: Chicago, Detroit, Cleveland, Los Angeles, San Francisco, Seattle

LOAD BUILDING

Commercial
Industrial

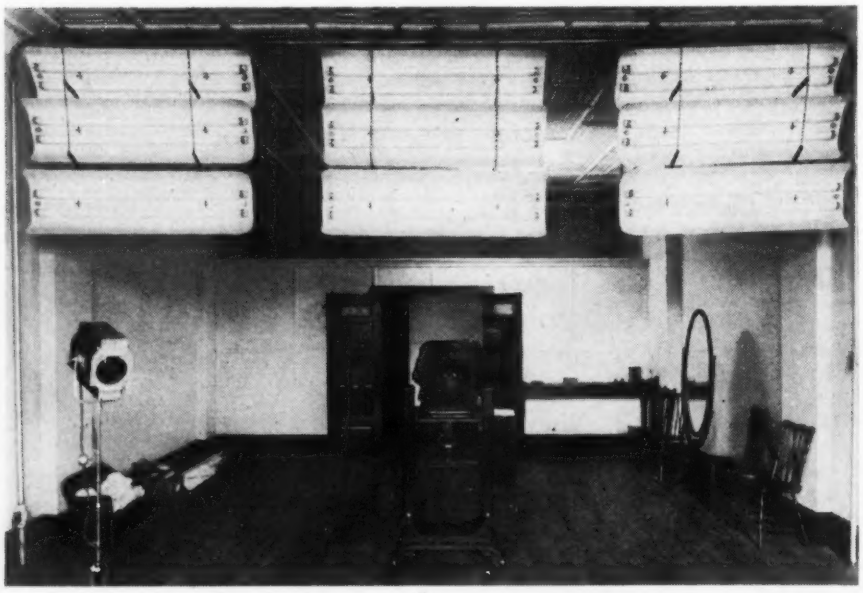
Residential
Rural

Photo Studio Lighting Attracts Patronage

RALPH A. POTTER
Lighting Engineer
Northern Berkshire Gas Co.
North Adams, Mass.

In connection with the relocation of the photographic studio of James Smith, Adams, Mass., the proprietor devised a lighting plan involving the use of fluorescent units consisting of nine industrial-type, 100-watt, double lamp fixtures mounted in three rows on a pipe frame above the camera, supplemented in the studio by a 500-watt, incandescent spotlight. The requirements were flat and even illumination over a wide area, bright without causing squinting and soft enough to eliminate deep shadows. The units are mounted 8 ft. above the floor to the bottom of the fixture lower row and 12 ft. to the top. The studio proper is 40-ft. long by 20-ft. wide by 13-ft. in ceiling height, and the sitter normally is placed about 12 ft. from the camera. Each fixture is switched and can be tilted at any desired angle by a chain and yoke adjustment. The main light source in the studio occupies a space about 5-ft. wide by 20-ft. long, and from 75 to 90 foot-candles of vertical illumination are provided on the subject. Highlights of 250 foot-candles or more are available from the spotlight sources, which include a portable fluorescent fixture similar to the fixture employed in the main units. Much work is done with color photography, including wedding groups aggregating some four per month on the average, which use the lighting service about 1.5 hours each.

In a typical month the establishment (including retail shop, darkroom and other work rooms) used 374 kw.-hr., costing $21.72. About 108 sittings were held, the lights being on about 30 min. per sitting. Ordinarily some nine pictures are sold per sitting. It is estimated that about 120 kw.-hr. per month are used in the studio proper at 5 cents per kw.-hr. The old location used about 25 percent of this, but business has improved in the newer layout as well as quality of work.



FLUORESCENT UNITS in James Smith Studio, Adams, Mass., provide new lighting arrangement for professional photography, with wide range of adjustment and desirable load for utility. Vertical illumination 75 to 90 foot candles

Locker Plants Become Refrigeration Stores

Complete "cold centers," serving entire communities or towns and offering services ranging all the way from the storage of furs and blankets to the processing and storage of frozen foods, now are envisioned by leaders in the mechanical refrigeration industry.

Their forecast is based on two factors. The first is the steady growth in popularity throughout the country of frozen food locker plants, at present numbering more than 6,500. Second is the increase in the essential services performed by mechanical refrigeration, now past the 200-mark.

The idea of "general refrigeration stores" is just as logical as super markets, department stores or even hospitals, officials of the Refrigeration Equipment Manufacturers Association pointed out recently. The chief difference would be that the "cold centers," in addition to serving retail customers, also could supply commercial refrigeration requirements—aging meat for nearby butcher shops, for example, or storing perishable foods for restaurants and hotels.

These centers will not interfere in any way with existing refrigeration facilities in homes, stores, offices or factories, but would supplement them by becoming headquarters for any type of refrigeration service with refrigeration specialists in charge. They are expected to start as an expansion of locker plants or even of ice plants.

Store Departments

A retail department might be added where "fresh-frozen" home-grown fruits and vegetables, ice cream and many frozen products would be sold. In the commercial department would be the storage of such products as frozen cream for ice cream makers, facilities for precooling fruit before it goes through processing machines, storage of frozen foods for merchants and brokers and operation as a substation for milk routes. In addition,

On what does the dealer's future depend today? On a good location? On a good line of home appliances? An aggressive merchandising program? Yes . . . on all of these—and also on a most important factor . . . the selection of the men who will form his future sales organization.

The dealer looking to the future will plan to create a coherent team of men who possess real ability, proved or potential, at building long-range good will and *sales* in the community—men who have chosen a life-long *vocation* in sales.

This is the *Kelvinator* way—and here is what Kelvinator has done to assist every Kelvinator retailer in making it his way.

On the opposite page, you see a Kelvinator dealer handing a booklet to a prospective salesman. That booklet . . . entitled "TO A MAN IN SEARCH OF HIS FUTURE" . . . is the number one piece in the most advanced and scientific program for training men in retail appliance sales ever developed: Kelvinator's great Vocation-in-Sales Program!

Developed out of Kelvinator's Retail Sales Management Forum back in September, 1944 . . . supplemented and extended through exhaustive research by leading vocational authorities . . . Vocation-in-Sales gives the dealer a practical and scientific method for finding, training and developing men who can succeed as appliance salesmen.

Following the first phase illustrated on the other page . . . the *finding* phase . . . Kelvinator's V.I.S. Program furnishes the retailer with material for *selecting* the right men . . . for *training* them . . . for *continuing* their development, not only through the period till product is available in quantity, but right on into the following period when real old-fashioned competitive selling becomes necessary.

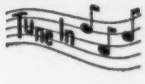
All of this help comes to the Kelvinator dealer as a part of his Kelvinator Franchise . . . as a part of Kelvinator's whole Retail-Minded Program . . . and is an example of a Kelvinator way of thinking and doing business that makes the Kelvinator Franchise . . .

The most Valuable Franchise in the Appliance Industry

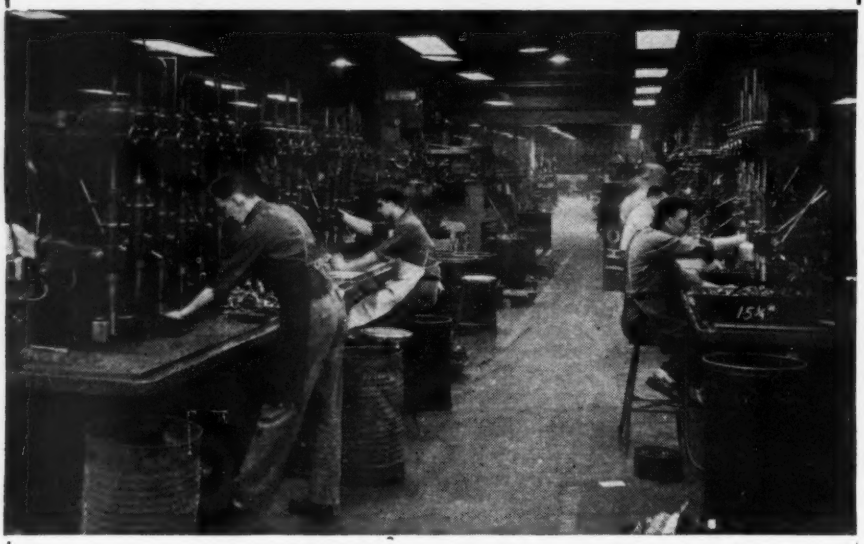
RETAIL-MINDED

Kelvinator

DIVISION OF NASH-KELVINATOR CORPORATION

Kenosha · Milwaukee · DETROIT · Grand Rapids · Lansing

N-K MUSICAL SHOWROOM
Nash-Kelvinator's *new* hit musical show, with the Andrews Sisters, Curt Massey and Guest Stars—*every Wednesday evening at 10:30 P. M., E. S. T.—Columbia Broadcasting System.*

THE REFLECTOR IS THE BACKBONE OF ANY LIGHTING SYSTEM . . .



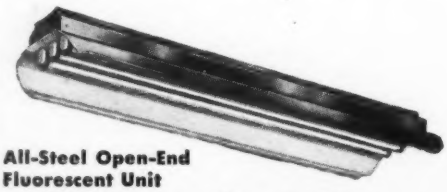
Put competition in the dark with

Skilled Lighting!

With competition coming back and factors of lower cost or higher quality looming larger in your selling plans – make Skilled Lighting your all-powerful ally. Eyes see better and hands work faster in ratio with expert lighting as surely as accuracy increases and quality improves! Worth looking into, isn't it?

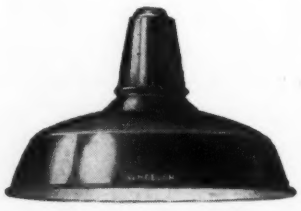
The need is almost invariably for more than just "a lot of light". It calls for all-over, shadow-free, directed illumination assured by Wheeler Reflectors – maximum illumination from standard lamps! The comprehensive Wheeler line of reflectors for fluorescent or incandescent installations is built for long, efficient service – high grade, heavy duty materials with heavy vitreous enameling. Sixty-four years of specialized light engineering backs the performance of every unit.

Learn how you can lift your quality and lighten your cost load with Skilled Lighting. Write for Catalogs today. **Wheeler Reflector Company, 275 Congress St., Boston 10, Mass.** Representatives in principal cities.



All-Steel Open-End Fluorescent Unit

Available for two or three 40-watt, or two 100-watt lamps. Broad wiring channel with accessible, enclosed ballast. Can be mounted from chain or conduit, individually or in continuous runs.



RLM Solid Neck Incandescent Reflector

Maximum lighting efficiency for either indoor or outdoor use. Expertly designed, ruggedly built. 75 to 1500 watts.

Distributed Exclusively Through Electrical Wholesalers

Wheeler Skilled Lighting REFLECTORS

Made by Specialists in Lighting Equipment Since 1881

a sales and service department would handle refrigeration and air conditioning equipment, including household refrigerators, home and farm frozen food units, and other types of home, commercial and industrial installations.

Business in prepacked frozen foods, with 2,000 or more frozen food packers predicted in the not too distant future, may give further impetus to the "cold center" idea, REMA officials say. Localized facilities for processing and freezing foods in bulk and then packaging them in much the same manner as local canneries operate would be provided. Before the war, there were less than two dozen frozen food packers. Today there are 800 or more, and both food and refrigeration circles look for wide changes in methods of producing, distributing and selling frozen foods of all descriptions. Already there are frozen food stores that offer the housewife a complete frozen meal, starting with appetizer and soup and continuing through as many courses as she cares to serve.

•

"Pay-as-You-Go" Farm Electrification

W. D. HEMKER

Supervisor, Rural Electrification Section Westinghouse Electric Corp., Pittsburgh, Pa.

Electricity is working for Joseph Motz on his 160-acre dairy farm in Trumbull County, Ohio, for an average wage of 18 cents per hour. Typical of 85 percent of the farms in America that produce approximately half of the country's farm products, the Motz farm is one of millions that make-up the rural electrification market. This farm is the testing ground of a cooperatvie research program which includes Mr. Motz, the Ohio Public Service Co. and the Westinghouse Electric Corp. The Motz farm did not have electric service prior to the setting-up of the project. This made it possible to obtain complete time and cost records of doing farm and home work without the help of electricity; consequently a comparison can be made of these various activities as they are electrified.

The Doane Agricultural Service Inc., of St. Louis, Mo., one of the country's leading farm management organizations, is supervising the collection of records and analyzing the results on a farm management basis.

The Ohio Public Service Co. is making time and motion studies of all farm work before and after the application of electricity. Mr. Motz is paying all power and equipment costs out of his income on a definite pay-as-you-go basis. This is one of the primary factors in the program, whose purpose is to find out exactly where electricity, properly applied, will pay for itself and make a good return to the farmer. In this way, over a period of years, a farm can become completely electrified with a relatively low initial outlay of money.

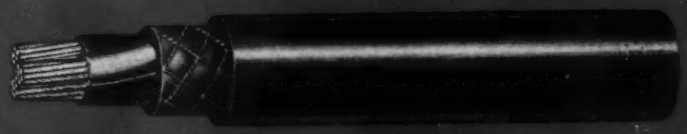
Savings in First Two Months

Analysis of the records of the past year revealed that, while it was not expected that electrification would show much result until some major equipment had been installed, nevertheless, there was a small profit in the first two months. Savings of $17.57 were credited to electricity for doing farm tasks, which after the electric service bill of $10.92 was paid, left a net operating profit of $6.65. An outstanding example of savings showed up in the use of a ½-hp. utility motor to operate a sickle sharpener during the haying season. It cost but 3 cents for electricity and required three man-hours to sharpen the sickle electrically for the entire season as against $6 for machine sharpening in town and 10½ man-hours for touching up by hand on the farm. The direct saving amounted to $5.97 cash plus 7½ man-hours per season. On this basis, the grinder would be paid for in three haying seasons since it cost but $15.30. From then on it would contribute to the over-all profit of the farm and the savings effected could be applied toward the purchase of other farm equipment.

Water System Pays

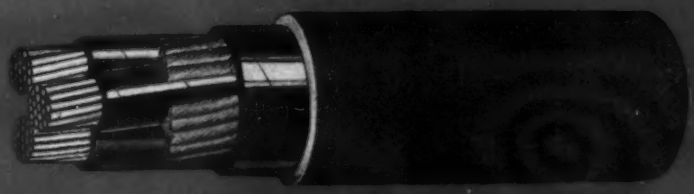
The records show that it required 4.66 man-hours to produce 100 lb. of milk during January, February and March of 1944 when the cows were watered by hand, and 3.80 man-hours during the same three months in 1945 when the cows were watered by an electric pump and automatic drinking cups. With continuous water before the cows it was found that 10.6 gallons of water were consumed per day per cow and that the average milk production per day from 11 cows was 221.62 lb. When the cows were watered twice a day by hand these

CRESCENT
WIRES & CABLES
Will Meet Your Need



Imperial Neoprene Portable Cords & Cables

Rubber Covered Wires & Cables



Varnished Cambric Lead Encased Cable

Parkway Cable, All Types

AND AMONG OTHER TYPES THE FOLLOWING:

ABC Armored Cable
Armored Ground Wire
Bare Copper Wire & Cable
Bell Wire
Brewery Cord
Control Cables
Fire Alarm Cable
Fixture Wires
Flexible Cords
Flexible Steel Conduit
Heater Cord
IMPERIAL CRESCORD Jacketed Cord
PERMACORD
Power Cables
Service Entrance Cable
Shipboard Cable
Signal Cable
Slow-burning Wire & Cable
Switchboard Wire & Cable
Telephone Wire & Cable
Thermostat Cable
Trench Cable
Weatherproof Wire & Cable
Welding Cable

CRESFLEX Non-metallic Sheathed Cable

CRESCENT
WIRE AND CABLE
CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.

REMEMBER

Jerry?

● He's the chap responsible for all those Jerry-built lighting fixtures that broke out like a rash o'hives these past few hectic years.

Worst of all Jerry is still around, making the same dubious kind of lighting equipment . . . and still "hooking" certain unsuspecting buyers. SILV-A-KING products, on the other hand, are honest, through and through. They're made of dependable, seamless heavy gauge steel . . . drawn in one piece. Their efficient lifetime reflectivity is the result of a porcelain enamel finish typically SILV-A-KING!

You'll find it good practice to specify SILV-A-KING Products now, and for years and years to come.

SILV-A-KING
"SPECIFICATION"
Lifetime porcelain fluorescent unit

BULLETIN 43 FS—YOURS FOR THE ASKING!

BRIGHT LIGHT REFLECTOR CO. INC.
Fairfield and State • Bridgeport 5, Conn.

SILV-A-KING
LIGHTING EQUIPMENT

figures were 6.9 gallons and 216.10 lb. respectively. The cows consumed 53.6 percent more water and produced 2.55 percent more milk when water was continuously before them. Based on milk production during the winter of 1944 and figured on the basis of the 5 months, increase in milk income figures out to $36.35.

The total cost of the entire water system was $282.07 and it makes a direct saving of 17½ man-days during the 5 winter months. Valuing labor at 64 cents per hour, the actual labor rate earned on the Motz farm in 1944, the time saved is worth $112.00. Add to this the increased milk check of $36.35 and the total represents the yearly value of the water system. The pump uses 0.397 kw.-hr. per day. At 3 cents per kw.-hr. the 5-months pumping comes to $1.79. Depreciation is figured at 7 percent of $282.07. Allowing $5.00 per year for maintenance, the net profit per year is $121.82, sufficient to pay for the water system in a little over two years.

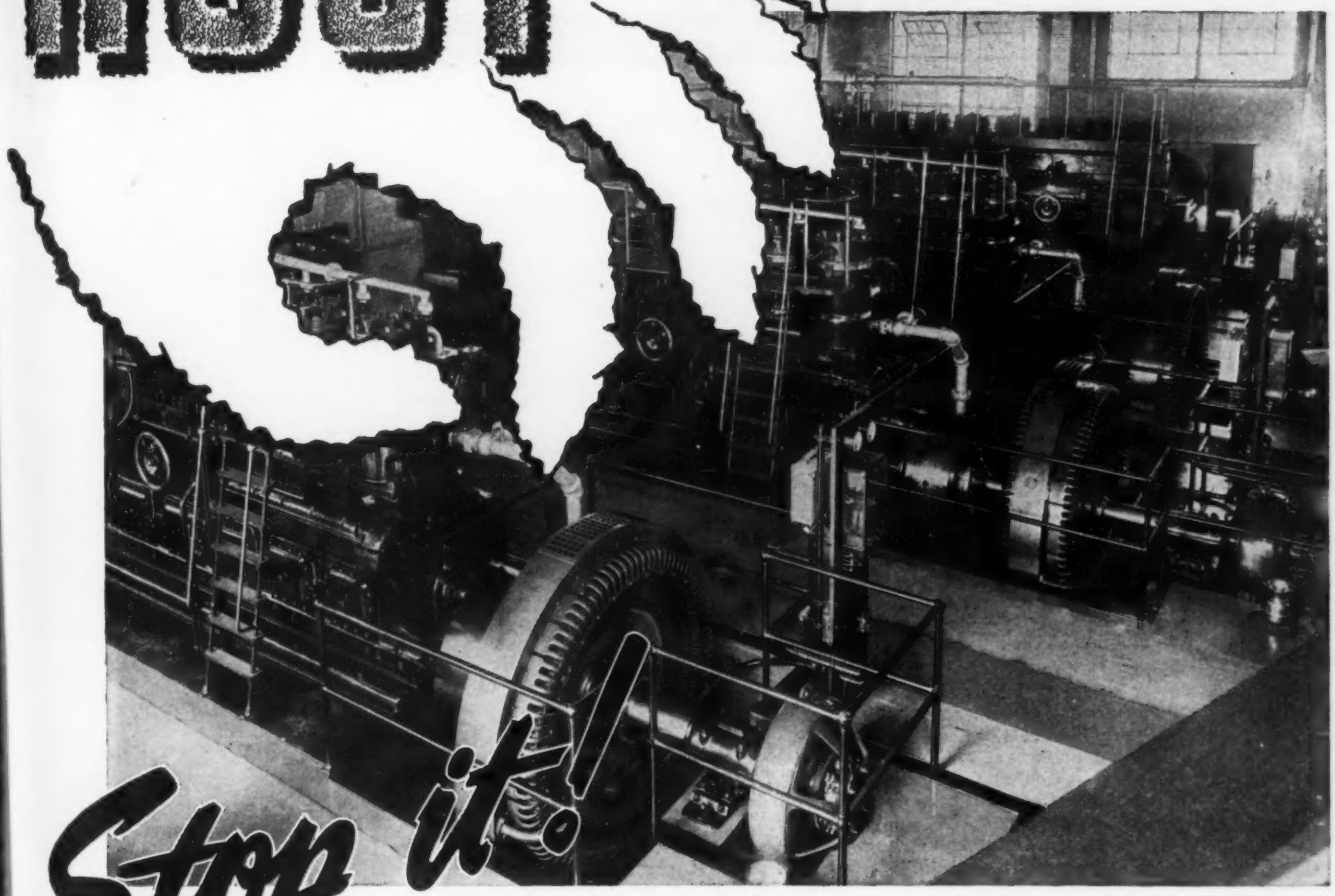
Man-Hours Saved

A review of the time saved by electric service shows the following:

ITEM	MAN-HOURS SAVED
Water System	
35 hours per month pumping water and watering cows—2 months	70
Sharpening Sickles	
12 sickles, 1½ hours each	18
Washing Clothes	
3 hours saved per week. 12 hours per month, 8 months	96
Ironing	
1 hour per week, 4 hours per month, 8 months	32
Lights	
3 hours saved per month cleaning and filling lamps, 8 months	24
Cleaning Wheat	5
TOTAL	245

Labor time of 245 man-hours was saved during the first 8 months use of electric service at a cost of $44.10. In other words, electricity was "hired" at a rate of 18 cents per man-hour. The over-all farm operation gave a labor return of 64 cents per man-hour; therefore, the electricity netted 46 cents for every hour saved. This net saving did not come directly to Mr. Motz and his family in the form of money, but it made possible more timely handling of crops and enabled them to give more attention to livestock and to do other work that otherwise might have been neglected. Also, it removed some of the drudgery from their work and gave time for thought toward organizing the farm operation for greater efficiency and a fuller farm life.

RUST STEALS MONEY



Stop it!

Those millions of dollars stolen annually by rust's scaly fingers . . . why let them be your dollars? Stop the rust thief in your plant!

Sinclair preventives that helped solve the war's tremendous rust problems are available to end *your* rust troubles. Whether it be protection for

- machinery in regular operation,
- machinery in short-time or extended storage,
- machinery in transit,
- piping, shafting, etc., exposed to corrosion,

there's a Sinclair *war-tested* preventive that *stops* rust . . . extends equipment durability . . . lengthens the life of metal installations.

Sinclair rust preventives are easily applied, easily removed – and they protect both internal and external surfaces.

Write us for information about application of Sinclair Opaline* RP Oils, and Sinclair Rust-O-Lene* rust preventives to your problems.

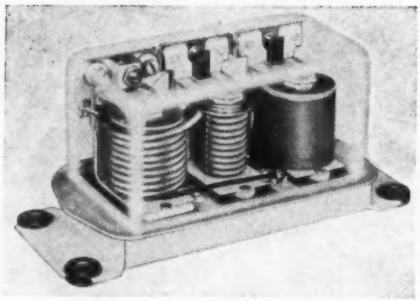
*Reg. U. S. Pat. Off.

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

NEW EQUIPMENT

Voltage Regulators



Vibrating type voltage regulators for low voltage d.c. generators: max. cap. 30 amp. at 6 to 32 volts and 45 amp. at 6 to 12 volts d.c.; max. field current rating—3 amp. at 6 volts and 0.5 amp. at 32 volts; dimensions—7¾ in. wide, 4 in. deep, and 3½ in. high; wt. 3.25 lb. **R-B-M Mfg. Co.**, Logansport, Ind.

Regulators are designed for use on gas engine or motor-driven generators. All three units (reverse current relay, voltage control, and current limitor) are designed to operate in any position and to withstand external vibration and shock encountered in mobile apparatus. The complete assembly is sealed in a gasketed, drawn steel enclosure and is said to be dust and waterproof.

•

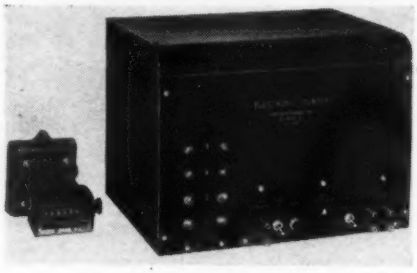
Rectifier

Adjustable voltage rectifier. **Mellaphone Corp.**, Rochester 12, N. Y.

A line of rectifiers having a d-c output voltage variable from zero to full voltage for industrial or laboratory applications is made in models which can be connected to any specified a-c power line. The control of the d-c voltage is obtained by the regulating knob on the front panel. The voltage regulation is obtained by the use of adjustable voltage transformers and mercury vapor rectifier tubes. Mounting of the tubes outside the main housing is said to provide for proper cooling and freedom from arc-back. The rectifiers are made with or without filtering in the d-c current circuit.

•

Counter

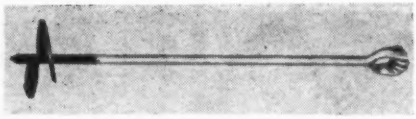


Two-decade electronic high-speed counter: counting rate up to 20,000 per sec.; operates on 115-volt, 60-cycle circuit; 13½ in. wide. 8⅞ in. high, 10 in. deep; wt. 26 lb. **Potter Instrument Co.**, 136 Roosevelt Ave., Flushing, N. Y.

Unit was developed for application where counts exceed 10 per second. The instrument comprises an input section, suitable for the four following types of input circuits—(1) contact closure, (2) pulse signals, (3) sine-wave signals and (4) square-wave signals.

•

Screw Anchor

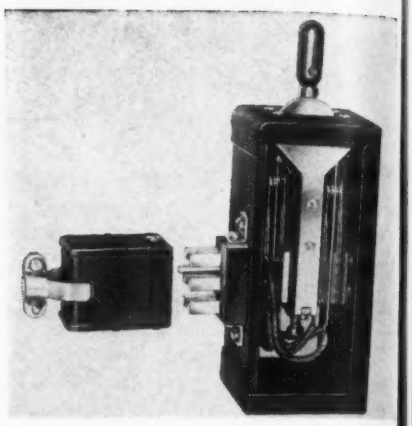


All-steel, no-wrench screw anchor: 4, 6, 8 and 10-in. diameters. **A. B. Chance Co.**, 210 Allen St., Centralia, Mo.

Anchor consists of a drop forged steel "tripleye" rod which is double arc welded to a forged steel blade. The "thimbleye" admits a bar for screwing the anchor into the ground and thereby eliminates the need of a wrench. It will accommodate up to three strands. The entire anchor is said to be galvanized and the helix to be dipped in black asphaltum paint. The anchor was developed for use in sandy soils.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Switch

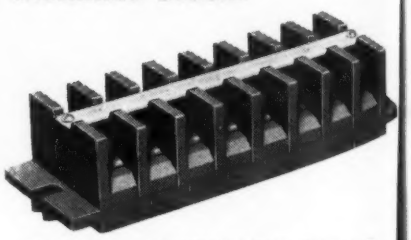


Series 4101-KP lever switch; 20 amp. at 110 volts, non-inductive; size 2⅝ in. x 2⅜ in. x 5 ¼ in. **Donald P. Mossman, Inc.**, 612 N. Michigan Ave., Chicago 11, Ill.

Switch is designed for use on reel motors or for installation necessitating a complete unit for starting and plugging motors. Installation permits servicing of single motor or multi-motor machines without cutting out other circuits. It is mounted in a metal box and wired to a terminal plug. A cable socket is supplied, or a plug can be placed on the housing. The connector used is a standard type plug or socket. The unit is said to be lint and dust-proof.

•

Terminal Blocks

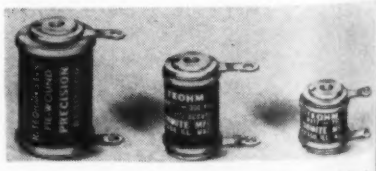


"Add-A-Point" terminal blocks. **Wama Co.**, Industrial Building, Baltimore 2, Md.

Terminal blocks may be built up to any desired size by adding unit-to-unit. They are rated up to 60 amp. and may be utilized with potentials up to 750 volts. Each Add-A-Point consists of a one-piece point and barrier, marking strip and short screws. It is reported as simple to assemble and as simplifying the stock problem.

•

Resistors



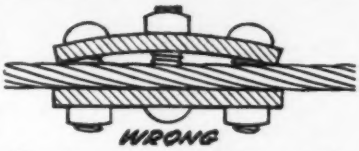
Series 84 precision resistors: pie-wound to 1 percent accuracy; resistance from 0.1 ohm to 200,000 ohms. **Ohmite Mfg. Co.**, 4835 Flournoy St., Chicago 44, Ill.

Units are made of a specially enameled alloy resistance wire that is non-inductively pie-wound on a non-hygroscopic ceramic bobbin which has a hole through the center for a No. 6 screw. The units are vacuum impregnated for additional insulation support and protection against humidity. They can also be supplied with a varnish to resist fungus growth. Uses reported are for

WHY?

DO HUBBARD STRAIGHT GROOVE GUY CLAMPS HOLD BEST?

1. **Because:** The **straight groove** eliminates the possibility of drawing a nut tight against an "arched" section which is out of contact with the strand.



Clamping area reduced by warped section. Causes slippage at low strains.

Hubbard Clamps have full clamping area. Hold to breaking strength of most strands.

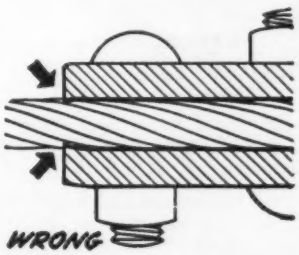
2. **Because:** The **straight groove** fits any and all twists, right or left hand and a variation in diameter without **creating** any high spots to **lessen clamping area.**

High spots in clamp reduce clamping area, cause slippage and injure strands.

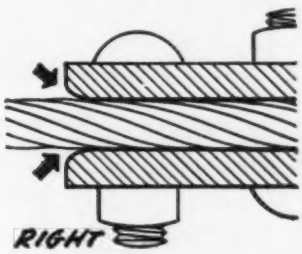
Hubbard Clamps fit snugly over any and all twists, right or left and variations of diameter.

3. **Because:** Bell-end grooves prevent injury to the strand.

4. **Because:** High carbon bolts prevent stripping or elongation. Heads are locked against turning while tightening—and the whole clamp is protected against corrosion by the best process commercially used — HUBBARD DOUBLE-DIP HOT GALVANIZING.



Sharp edge from sheared section injures and weakens the guy at end of clamp.



Rounded ends of Hubbard Clamp sections protect strand.

HUBBARD and COMPANY

Pittsburgh Oakland, Calif Chicago

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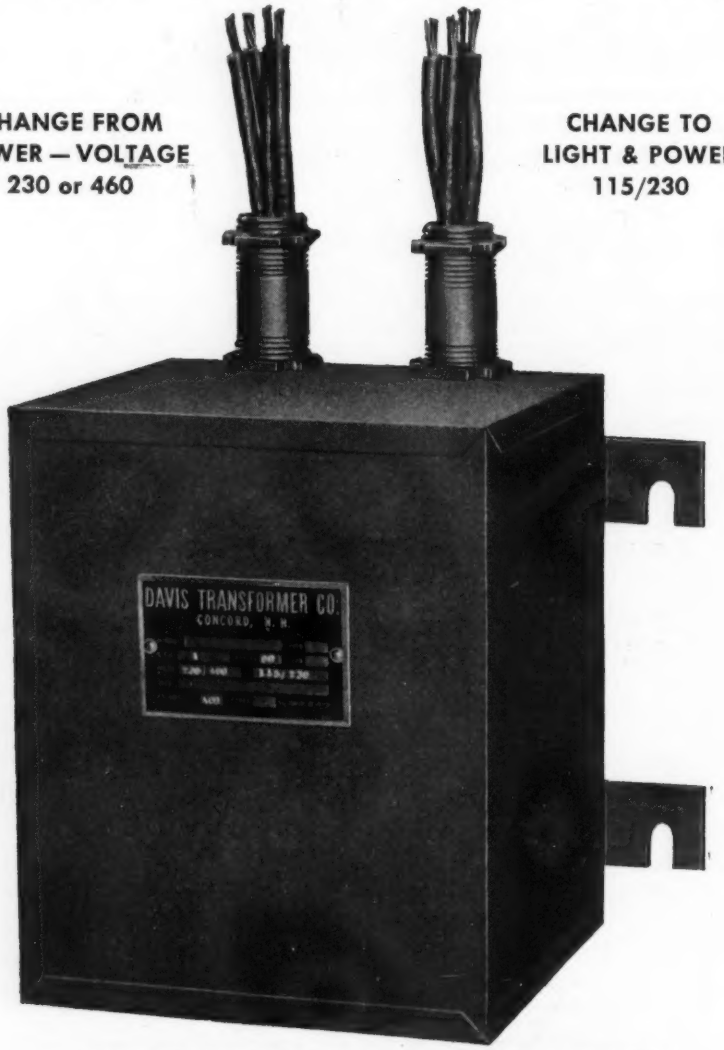
DRY TYPE TRANSFORMERS FOR POWER AND LIGHTING LOADS

CHANGE FROM POWER — VOLTAGE 230 or 460

CHANGE TO LIGHT & POWER 115/230



UNIT ILLUSTRATED IS FOR WALL, POST OR FLOOR MOUNTING FROM ½ KVA TO 10 KVA.
OTHER DAVIS DRY TYPES FOR ALL PURPOSES

ORDER NOW! STOCK SHIPMENTS

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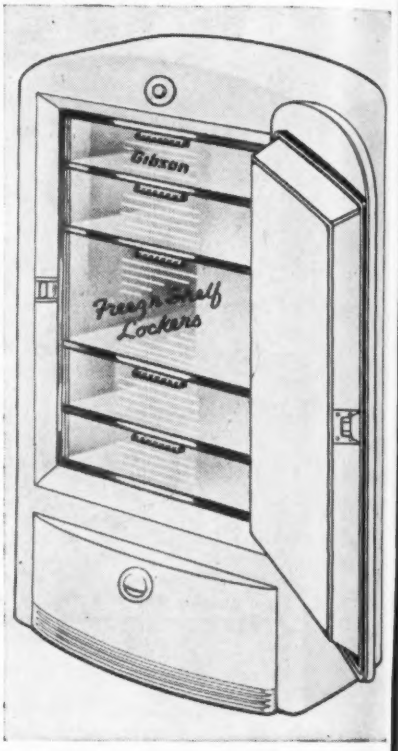
Manufacturers of Oil Cooled, Dry Type, Power and Distribution Transformers
Also All Types of Specialty Transformers Regardless of Size

voltmeter multipliers, laboratory equipment, test sets, attenuation pads, and in electronic equipment.

•

Home Freezer



Six cu. ft. home freezer: motor, ⅛ hp.; compressor, reciprocating, hermetic type; porcelain enamel exterior; baked white enamel interior; height, 61 15/16 in., width 30 1/8 in., depth 27 5/16 in. **Gibson Refrigerator Co.**, Greenville, Mich.

Clear-view, upright home freezer has the interior arranged similar to an office file; five individual freezer compartments with individual pull-down glass shelf-doors. The exterior is similar to a refrigerator with swing-back door.

•

Relay

Millisec relay; sensitivities from 0.5 milliwatts and ratings up to 5 amp.; for use on 110 volts a-c circuits. **Stevens-Arnold Co., Inc.**, 22 Elkins St., South Boston, Mass.

Relay is said to be a hermetically sealed unit capable of speeds up to 1,000 operations per second. It has a glass envelope

you can get to work with plastics

NOW

here's

HOW

Here's a new Dow plastic that gives you the rare opportunity to put your plastic plans to work—*RIGHT NOW!* Most plastics are still short. But this new Dow development—its durability and effectiveness proved in war—is now freely available for the many peacetime jobs that call for its unique qualities. It may be just the thing you need. Suggested applications include tools, electrical insulation, home appliances, sporting goods. Field experience and Dow research point unmistakably to a world of opportunities for new and profitable civilian applications. Full data is waiting for you. Push your plastic program—*NOW*—ask Dow about Styraloy at once!

STYRALOY

SOMETHING REALLY DIFFERENT IN PLASTICS
For better insulation, tool handles, and products as varied as scuff plates, floor mats and fittings or gaskets, Styraloy is the answer to tough service demands.

CHECK THESE PROPERTIES
High dielectric strength, low power loss; flexible and shock resistant from −90° to 212° F.; light weight; negligible water absorption; resists heat, many chemicals, permanent indentation and abrasion; easily machined.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN
New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago
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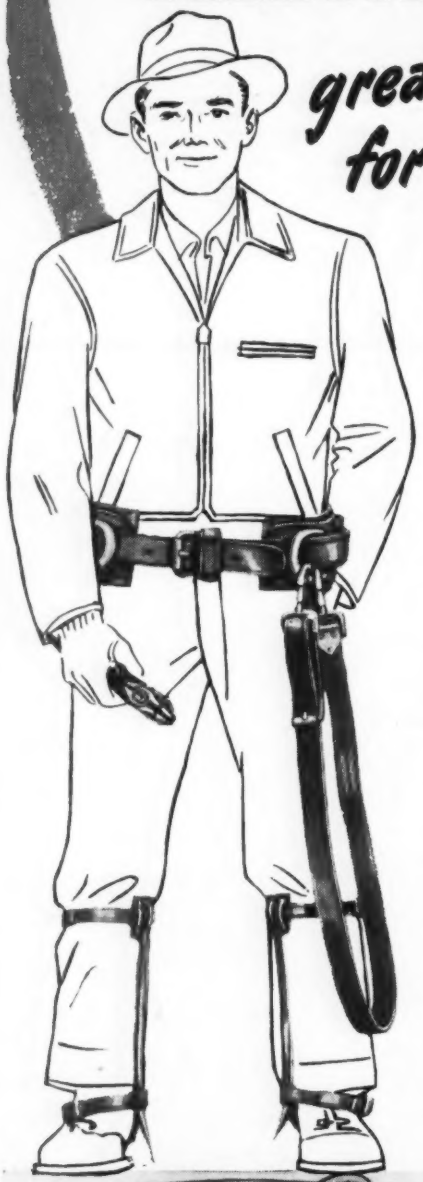
KLEIN-KORD...
greater safety for LINEMEN!



Klein-Kord Safety Straps, developed more than ten years ago, are today used exclusively by many of the country's largest public utilities.

Multiple plies of long staple cotton of a special weave are vulcanized in rubber. This weave permits the use of a tongue-type buckle without risk of slipping or ripping, even under severe tension and excessive loads. The red center provides a warning signal. The strap is safe for use until worn down to the center ply—"Stop when you see red."

Klein-Kord is extremely tough, flexible, and of uniform thickness and strength. It has a low conductivity, will not stretch, and is unaffected by moisture.

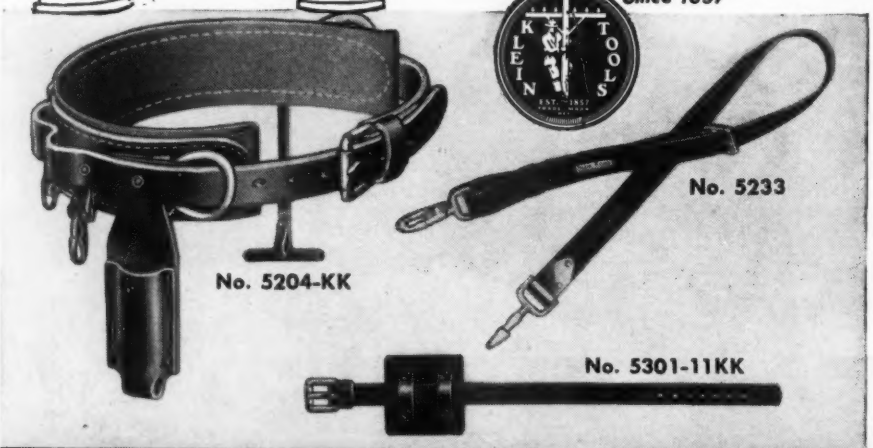
An improved Tool Belt of Klein-Kord is also available. This belt has found favor with linemen, and offers the quality features that have made Klein Belts the choice of linemen for generations.

Klein-Kord is an exclusive Klein development available only on equipment carrying the Klein trade-mark.

Write for book giving full information on Klein-Kord Safety Straps and Belts.

Foreign Distributor:
International Standard Electric Corp., New York

Since 1857



Mathias KLEIN & Sons
Established 1857 **Chicago, Ill., U.S.A.**
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

which surrounds all moving parts and is said to protect them from moisture, dust and corrosive fumes.

•

Voltmeter

Model "451" vacuum tube voltmeter and Model "101" amplifier: a.c. and d.c. range 0 to 1,000 volts; d.c. current, 0 to 1,000 ma; resistance, 1 ohm to 1,000 megohms; a.c. frequency range 10 c.p.s. to 700 megacycles; wt. 20 lb.; size 10¾ x 9 x 8 in. **Reiner Electronics Co., Inc.**, 152 W. 25th St., New York 1, N. Y.

Instrument was designed for laboratory and instrument use. Its 25 millivolt a.c. on the lowest range; 1,000 volts on the highest range, 10 c.p.s. to 700 megacycle frequency range and the 7 micro-farads input capacity permits obtaining a comprehensive range of voltage, current and resistance readings. The unit has single linear scale for all voltage and current scales, single zero adjustment, voltage regulated supply and a reported accuracy of 2 percent for full scale readings.

•

Amplifier

Video amplifier: gain approximately 1,000; operates on 110 to 120-volt, 60-cycle circuit; consumes 100 watts wt., 35 lb.; size, 7¾ in. x 8 in. x 20¾ in. **United Cinephone Co.**, Torrington, Conn.

Unit was designed to amplify complex waves which are to be viewed on an oscilloscope and for tracing and measuring small r.f. voltages. The frequency response is said to be flat within 1.5 db. of the 10 kc. response from 15 cycles to 4 megacycles, and 3 db. from 10 cycles to 4.5 megacycles. Input is normally through a probe having an attenuation of 10 times. The amplifier direct input (without probe) is approximately 2.2 megohms of resistance in parallel with 40 mmfd. This compares with 1.1 megohms resistance in parallel with approximately 18 mmfd. when the probe is used. Output voltage can be adjusted from 0 to 50 volts r.m.s. with sine wave signals. The ripple is reported as less than 0.5 volts for all operating conditions and all positions of gain control.

NEWS ABOUT PEOPLE

Electrical Manufacturers Elect White President

Richard L. White, president of Landers, Frary & Clark, has been elected president of the National Electrical Manufacturers Association.

Mr. White brings to the NEMA presidency a broad background of manufacturing, sales and finance developed

R. L. White

during his constant association with the appliance industry. His wide range of experience covers practically every phase of manufacturing in the production of household merchandise.

His education at Harvard University was interrupted by World War I, but following the close of hostilities, he returned to the University and was graduated with honors in 1920. He immediately entered the electrical manufacturing field with Western Electric Co.

It was in 1923 that he joined Landers, Frary & Clark in charge of manufacturing and sales for the Stanley Vacuum Bottle Division. In 1927 he was made assistant treasurer of the company and the following year was appointed treasurer. In addition to this office, he also held the position of export sales manager. Mr. White has been president since 1941.

•

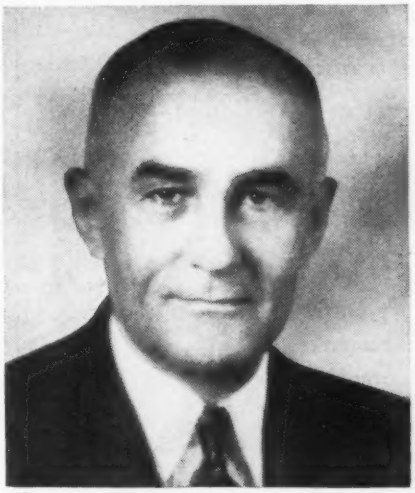
▶ JOSEPH G. BARIESAS has been appointed advertising manager of the Ohio Public Service Co., Cleveland. Mr. Bariesas goes to the Ohio utility from Washington, D, C., where he was assistant to the president of the Council of Electric Operating Companies. He was formerly associated with the Virginia Public Service Co. and the Seaboard Public Service Co. The position of advertising manager had been left open since the resignation of Kenneth L. Ede last spring.

•

Alabama Power Co. Elects Smith Vice President

Announcement has been made by the Alabama Power Co. of the election of L. M. Smith to the position of vice-president.

Mr. Smith, who has been with the company for 22 years, started as a draftsman. Most of his experience has



L. M. Smith

been in the engineering field, but for the past several years he has been engaged in public relations work. He has been director of public relations for Alabama Power for the past year.

•

▶ CHARLES G. ROBERTS, since 1943 manager of the electronics division of International General Electric Co., has been promoted to the position of manager of merchandise sales. F. L. MAGGINI has been named manager of the refrigeration and air conditioning division.

Irving Trust Co. Elects Walker Vice-President

Tom P. Walker, since 1942 president of the Council of Electric Operating Companies with headquarters in Washington, has been elected a vice-president of Irving Trust Co., New York, where he will be associated with the extensive business which the bank has with public utility companies.

Harris & Ewing

T. P. Walker

Mr. Walker was selected by 170 electric operating companies throughout the country to head the organization they formed early in 1942 in order that immediate nationwide cooperation could be achieved for the government in connection with the futherance of the war.

For 12 years prior to accepting that appointment Mr. Walker was president of the Gulf States Utilities Co. with headquarters at Beaumont, Tex. Prior to that he had been an executive of leading electric operating companies in several southern states and is widely known in the public utility field.

•

▶ DR. FREDERICK B. LLEWELLYN, of Summit, N. J., has been elected president of the Institute of Radio Engineers for the year 1946 to succeed Dr. William L. Everitt, head of the department of electrical engineering of the University of Illinois. A consulting engineer on the staff of Bell Telephone Laboratories, Dr. Llewellyn is an international authority on the design of vacuum tubes used for communication and electronic control purposes. In 1936 he received the Morris Liebman Memorial prize for his analysis of reactions within the vacuum tube.

•

▶ BERNARD W. SCHOTTERS, formerly a member of the legal department of the Indianapolis Power & Light Co. and an assistant secretary of the company, has been placed in charge of that depart-

The Makeup of *Outstanding* Panel Boards

20 ASCO Remote Control Switches Help Control 20 Plating Circuits

Several requirements led to the choice of ASCO Switches for the service to be rendered by these Charging Panel-Boards built by The Udylite Corporation of Detroit.

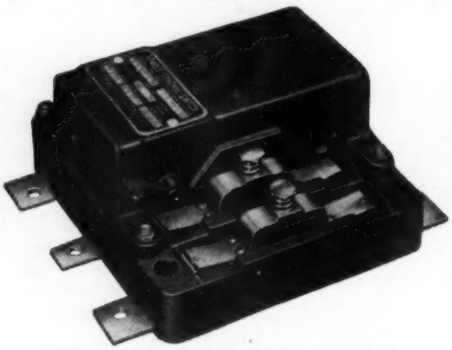
1 . . . The remote switches had to be positive in action—with minimum voltage drop at high current since plating voltage was 6 volts.

2 . . . They had to be compact to fit in available space.

3 . . . They should preferably be quiet with no hum or coil losses, therefore mechanically held.

Udylite, after investigation, selected ASCO "Type RC" Switches because they so well fulfil its requirements.

Perhaps the "Type RC" is what you need for your requirements . . . or perhaps it would be some other ASCO Automatic Switch, Relay or Contactor. Why not find out about our quality line of Switches?



"Type RC" Remote Control Switch

We also manufacture a complete line of Solenoid Operated Valves for automatic and remote control of liquids and gases.

ASCO *Electrically Operated* SWITCHES

Automatic Switch Co. 12-AS-4

41-C EAST 11th STREET • NEW YORK 3, N. Y.

ment and elected secretary. WILLIAM CANNICOTT, formerly assistant purchasing agent, has been advanced to the position of purchasing agent.

•

S. R. Knapp New Chairman of Interstate Power Club

S. R. Knapp, who was elected chairman of the Interstate Power Club at the first post-war meeting held recently in New York, (ELECTRICAL WORLD, November 24, Page 92), has been assistant to the vice-president in charge of sales of the Connecticut Light & Power Co. since 1941, with headquarters in Waterbury.

S. R. Knapp

A graduate of Cornell University in electrical engineering, Mr. Knapp worked from 1928 to 1931 in the research and general operating departments of Connecticut Light & Power. He was then transferred to the power sales department, continuing in that position until 1937 when he became manager of the New Milford district. It was in November, 1941, that he assumed his present position.

Mr. Knapp has been a member of the industrial power and heating section of the Edison Electric Institute for the past few years and at present is chairman of the sales personnel and training committee of that section.

•

▶ FRANK A. BANKS has been appointed supervising engineer for the million-acre Columbia Basin irrigation project and ROBERT J. NEWELL as regional director for the Bureau of Reclamation in the Pacific Northwest. Both men are veterans in service with the Bureau and in development of western water resources. Mr. Banks was supervising engineer for construction of Grand Coulee Dam and will now devote full time to completing the irrigation and power fa-

WAR-WIRED CIRCUITS

Prematurely Aged

by 12 years of severe service

You will probably grant that 3 or 4 years is more than a normal dependable lifetime for wire and cable operating in hot spots or under other severe conditions . . . but if you multiply by 3 the number of years your war-installed circuits have been in service you'll get a better idea of just how old they really are.

Another point to remember is that this *premature aging* was accelerated beyond calculation by 'round the clock year-to-year operation *without rest cycles.* All of which adds up to a lot of wire-failure possibilities in circuits that run around steam lines, furnaces, lehrs, annealers, soaking pits, or in boiler rooms, blooming mills or steam tunnels . . . power, control and lighting circuits that you may still consider too new to fail although *they are already prematurely aged and unsafe!*

And don't forget that a lot of the wire you put in when you had to take anything you could get wasn't built to take the kind of service it had to stack up against . . . so for safety and uninterrupted service take a survey of your trouble spots and rewire with *permanently insulated* Rockbestos A.V.C. 125 different standard constructions and National Electrical Code approved types to select from. For a catalog or information write to the nearest branch office or:

ROCKBESTOS PRODUCTS CORPORATION
114 NICOLL ST., NEW HAVEN 4, CONN.

BUY U. S. *VICTORY* BONDS

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK BUFFALO CLEVELAND CHICAGO PITTSBURGH ST. LOUIS
LOS ANGELES SAN FRANCISCO SEATTLE PORTLAND, ORE.

ROCKBESTOS A.V.C. 600 VOLT MOTOR LEAD CABLE
(National Electrical Code, Type AVA—max. operating temp. 110°C.)

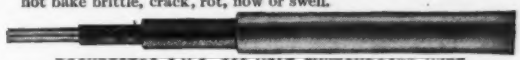
Size No. 18 AWG to 1,000,000 CM insulated with two walls of impregnated asbestos and a high-dielectric varnished cambric insert, with heavy asbestos braid overall.

Heatproof, fireproof and resistant to moisture, grease and oil—like the power cable pop Time is standing on—will not dry out and crack, won't burn or carry flame and remains permanently flexible. For coil connections, motor and transformer leads where extreme heat and fire hazards are encountered as in steel mills, factories, etc.

ROCKBESTOS A.V.C. 600 VOLT BOILER ROOM WIRE
(National Electrical Code, Type AVA—max. operating temp. 110°C.)

Sizes No. 18 to 8 AWG insulated with varnished cambric, impregnated felted asbestos and asbestos braid. Sizes 6 to 4/0 have another wall of impregnated asbestos next to the conductor.

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used A.V.C. construction is ideal. Its permanent insulation will not bake brittle, crack, rot, flow or swell.



ROCKBESTOS A.V.C. 600 VOLT SWITCHBOARD WIRE
(National Electrical Code, Type AVB —max. operating temp. 90°C.)

Sizes No. 18 to No. 4/0 A.W.G. with varnished cambric and felted asbestos insulation and gray, black, white or colored flameproof cotton braid.

Combine fire insurance and fine appearance in your switchboards with Rockbestos Switchboard Wire. It is absolutely fireproof and will not dry out under heat. Sharp, clean bends can be made without cracking as the asbestos wall acts as a cushion under the braid. Rockbestos A.V.C. Hinge Cable and Switchboard Bus Cable have the same fireproof and heatproof characteristics.

Another New Rockbestos Firewall Construction—
A 400°F. Wire!

War-developed Rockbestos High-Temperature Wire —*with a maximum operating temperature of 400°F.*— designed for jet propelled plane applications and circuits to hot-wing de-icers, fire detectors and extinguishers, and air conditioning and heating units where baking temperatures destroy ordinary insulation. Under continuous operation at rated temperature it retains its original dielectric strength and inherent resistance to heat and flame, and *progressively improves* in its resistance to moisture and abrasion. Now available for these and other severe applications. Write for complete information and samples.

They share the load AUTOMATICALLY . . . WITHOUT ATTENTION

Assuring an adequate and uninterrupted supply of direct current (for control bus, circuit breaker and emergency loads) . . . automatically and without manual attention . . . DEMANDS the "teaming together" of only the most dependable Batteries and Full-Automatic Chargers. That the "Diverter-Pole" Charger ranks at the top of the list is supported by thousands of installations made in the past 30 years . . . PROOF that the "Diverter-Pole":

★ **ASSURES MAXIMUM BATTERY LIFE** . . . Only the constant voltage method of charging protects the battery against over-charging during the Floating-Charge period. Analyze Zone 1.

★ **SHARES LOADS WITH BATTERY** . . . Its "constant-voltage" characteristic permits the "Diverter-Pole" Charger to carry *all* loads within its *safe* capacity. The change to a "constant-current" characteristic (Zone 2) shifts *automatically* dangerous overloads to the "team-mate" battery operating in Zone 3 . . . thereby protecting itself against harmful overloads.

★ **GIVES FULL-AUTOMATIC OPERATION** . . . Increasing use of "Diverter-Poles" in isolated automatic and supervisory-controlled substations is convincing evidence that this type of charger needs only infrequent inspection. Its voltage *automatically* remains constant despite fluctuations in load or a-c power supply.

Write for Descriptive Bulletin No. 96-A

THE ELECTRIC PRODUCTS COMPANY

1731 Clarkstone Rd. Cleveland 12, Ohio

EP

X-4

cilities of the Columbia Basin Project. Joining the Bureau staff in 1906, Mr. Banks has served in various engineering capacities in the construction of western Reclamation projects. Mr. Newell assumes his new position as regional director at the Boise, Idaho, office after having served as assistant and associate director since the Region I office was established in 1943. Mr. Newell joined the Bureau's staff in 1903.

•

F. H. King Made Manager of Holyoke Electric Dept.

Lt. Col. Francis H. King has been appointed manager of the Holyoke (Mass.) Gas & Electric Dept., succeeding the late John J. Kirkpatrick. Col. King was graduated from Worcester Polytechnic Institute in electrical engineering in 1928. He took flight training as a student officer in the U. S. Navy in Florida in 1929-30, and began work with the Holyoke department as a draftsman in 1931. He became electrical engineer in 1932 and assistant superintendent of the electric station a year later.

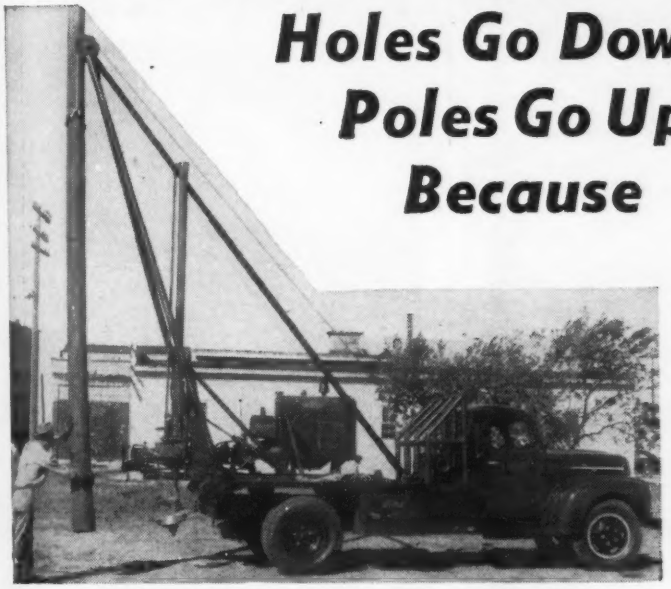
F. H. King

Loaned to the municipal light department at Burlington, Vt., in 1937, he remained as superintendent until late 1941, when he was appointed power consultant on the staff of J. A. Krug, then chief of the power division of the OPM. He had charge of emergency priorities issued by the WPB to all electric utilities. In 1942 he was assigned to the Army and Navy Munitions Board on electric power problems, later becoming chief of the electronics section of the resources division, H. Q. Army Air Forces. He was named provisional manager of the Holyoke department in October, 1945.

•

► W. T Ackley, who had been handling numerous wartime assignments within the Ohio Edison Co., has actively re-

JAQUES
HYDRAULIC EARTH BORING MACHINE

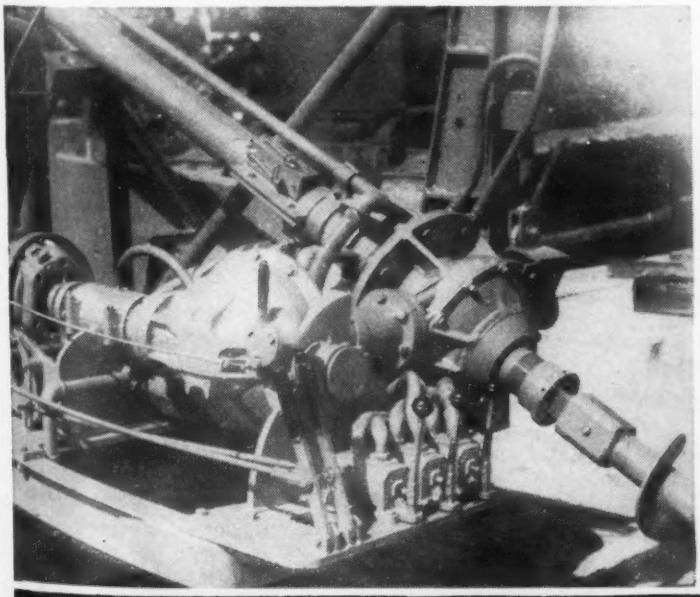


Holes Go Down Quicker, Poles Go Up Faster With a Jaques Because

1. All plumbing is hydraulic controlled, enabling faster transportation from hole to hole as machine can be instantly lowered to traveling postion.
2. Faster drilling, as the hydraulic feed maintains a constant pressure on the bit—the texture of soil controls the rate of digging.
3. Hydraulic pressure on bit transmits less shock to machine while digging in rock.
4. Operator fatigue reduced to a minimum.
5. Anchor holes are easily drilled at any angle.

HYDRAULIC FINGER TIP CONTROL

Reduces operator fatigue. One man easily operates this machine as all controls are conveniently located. Peak operating speeds easily mantained hour after hour with this simple, trouble-free hydraulic control.



SPECIFICATIONS

Motor—Int. Model U4—with electric starter. **Construction**—Unit mounted on steel-I-beam skids (easily attached to or removed from truck). **Drive**—Mechanical—four forward speeds and one reverse. **Feed**—Hydraulic. **Lift**—Hydraulic. **Leveling**—Hydraulic. **Hole Size**—Up to and including 24 inches (larger diameter on special order). **Depth of Hole**—8 to 9 feet with standard machine (greater depth on special order). **Weight**—3400 pounds. **Width**—4 feet, 3 inches; **Length**—10 feet.

Immediate Delivery on Standard Models

for Further Information Write or Wire

JAQUES POWER SAW CO.
DENISON, TEXAS

SIL-FOS and EASY-FLO

READY TO START ON NEW PRODUCTION

NOW!

Back from the production battlefront, SIL-FOS and EASY-FLO are ready to help you with new metal joining ideas. These two low-temperature silver brazing alloys are ready to boost metal joining production rates for you — and to slice production costs.

During the past few years, ways of getting maximum benefits from the fast brazing action of these two alloys, have been crystallized into definite production procedures, featured by preplacement of the alloy and the use of fast heating and handling methods.

No matter what your metal joining problem may be—whether it's the volume production of electrical connections, the fabricating of electrical equipment or the constructing of bus bar systems and switchboards—it will pay you to find out how and why SIL-FOS and EASY-FLO—the ideal alloys for electrical work—will make better joints for you, and do it faster and at lower cost. Deliveries on these alloys are nearly back to normal.

BULLETIN 12-A GIVES FULL DETAILS

It tells you all about SIL-FOS and EASY-FLO and how to put them to work. Write for a copy.

If you have a metal joining problem ask us for recommendations. No obligation. Or, if you'd like a field engineer to call, write us.

ARMY E NAVY

HANDY & HARMAN

HANDY & HARMAN FOUNDED 1867 QUALITY & SERVICE

82 FULTON ST., NEW YORK 7, N. Y.

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sumed charge of the dealer co-operation department, which is operated separately from the merchandise department. His title is general dealer co-ordinator.

•

Residential Sales Work Assigned to R. L. Coe

Union Electric Co. of Missouri has appointed Robert L. Coe to the position of residential promotion manager. Mr. Coe, who recently returned from service in the Navy, has been associated

R. L. Coe

with Union Electric since 1929. In 1937 he was appointed merchandise manager, in which capacity he served until entering the Navy in 1943.

In his new position, Mr. Coe will have the responsibility of supervising all residential sales and promotional operations throughout the system, including operations of the residential lighting and service division, home economics division, merchandising division, and as dealer sales counsellor. In addition to these duties he will temporarily act as merchandise manager.

Mr. Coe served as president of the St. Louis Chamber of Commerce Sales Manager's Bureau in 1942 and of the St. Louis Housewares Club in 1941.

•

► VERE C. HALLIDAY, for the past 20 years connected with the Utah Power & Light Co., has joined the company's general sales department staff in the capacity of sales promotion director. He will also assist in advertising and sales promotion activities. Mr. Halliday has a broad background of sales experience. He entered the power company's employ in 1924 as a member of the Salt Lake division, worked in various departments for two years and then was transferred to the Salt Lake sales department. In 1936 he was made sales-floor supervisor, in which position he remained until the company discontinued merchandising in June, 1942. Mr. Halli-

Over 300% increase in 3 years

... THE SWING IS TO VARNISHED FIBERGLAS* CLOTH FOR ELECTRICAL INSULATION

It's because of the unique combination of characteristics, found only in Fiberglas, so many electrical engineers have standardized on Fiberglas-base Electrical Insulation Materials.

THICKNESSES OF FIBERGLAS CLOTH

Fiberglas Cloths for varnishing are produced in thicknesses from .0015" to .015" permitting a wide variety of base cloths for various varnished thicknesses. Thickness of base cloth and finished thickness of varnished cloth should be determined by space-factor, dielectric strength and mechanical requirements of the particular application.

VARNISHED CLOTH AND TAPE

When properly impregnated, Fiberglas-base Insulation material has exceptional dielectric strength and insulation resistance. In addition it has unusually good moisture and temperature resistance and high tensile strength. The strength-to-thinness ratio of varnished Fiberglas Cloth is unmatched.

Varnished Fiberglas Cloth, in thicknesses from .003" to 030", is used wherever a high-dielectric material with good mechanical characteristics is required for equipment operating in high temperature, under adverse operating conditions, or where a greater factor of safety is desired. Typical applications are: phase insulation in a-c motors; high-dielectric and high-temperature coil insulation; ground insulation on the slot sections of preformed coils; layer insulation in air-cooled transformers, etc.

PERMITS USE OF THINNER INSULATION

Because of its higher dielectric strength and because it retains its mechanical and electrical characteristics under prolonged exposure to adverse conditions, thinner varnished Fiberglas Cloth or Tape than that required by the use of other materials will give equal or greater insulation.

Varying degrees of flexibility in varnished Fiberglas Cloth, of the same finished thickness and type of varnish, are possible by varying the thickness of the Fiberglas Cloth used as the base —yellow or black varnish treatment.

COMPLETE INFORMATION

If you do not have complete information on all types of Fiberglas-base Electrical Insulation Materials, write for Catalog EL 44-7 today. *Owens-Corning Fiberglas Corporation, 1858 Nicholas Building, Toledo 1, Ohio.*

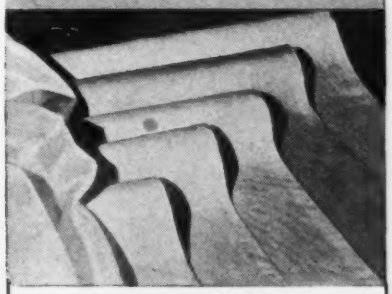
In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.

FIBERGLAS

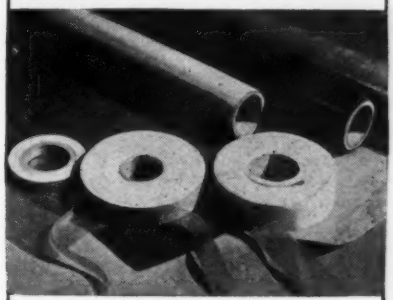
*T. M. Reg. U. S. Pat. Off.

ELECTRICAL INSULATION MATERIALS

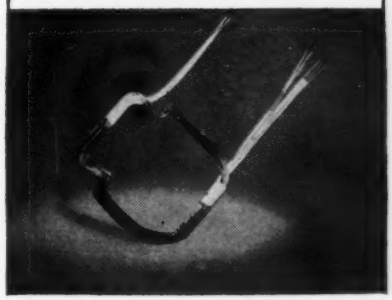
There is a FIBERGLAS Insulation Material for every need



Untreated, continuous filament, Fiberglas Cloth is made in thicknesses from .0015" to .015" — staple fiber cloth from .012" to .023".



Varnished Fiberglas Cloth is available in 36" widths or cut to any desired tape width.



Treated and untreated Fiberglas Tapes in various widths and thicknesses are used in winding all types of coils.

Write for Catalog E 44-7

Each distributor of Fiberglas-base Insulation Materials has his own source of supply, since Owens-Corning Fiberglas Corp. does not process these materials.

Crapo
STEEL CONDUCTORS

Because of its high tensile strength, its ruggedness and its conductivity, *Crapo* HTC-130 Steel Conductor is both practical and economical as an overhead ground wire. Its superior strength makes possible long spans with flat sags and greater clearances. Its rugged physical characteristics give it a high fatigue endurance limit, enable it to withstand severe shock and deformation.

The all-'round dependability and economy of *Crapo* HTC-130 Steel Conductor as an overhead ground wire have been established by its performance under actual operating conditions. Leading utilities have adopted it on the basis of their own experience.

• • •

Crapo Steel Conductors are distributed by Graybar Electric Company, Inc. Ask the Graybar representative or write for your copy of the *Crapo* Steel Conductor Manual!

Crapo HTC-130 Steel Conductors for overhead ground wires are available in Standard (3-wire) and Solid types. Physical properties for sizes No. 4 and No. 6 (B.W.G.), in both types, are shown below:

Conductor Size B. W. G.	Type of Construction	Diameter of Conductor (inches)	Minimum Breaking Strength (lb.)
4	3-wire	0.297	5610
6	3-wire	0.252	4295
4	Solid	0.238	5784
6	Solid	0.203	4208

INDIANA STEEL & WIRE COMPANY
MUNCIE, INDIANA

day was then assigned to a newly established department in the handling of War Production Board rules and regulations and construction applications pertaining to power company operations. Prior to taking his present position he was a member of the company's purchasing department.

•

A. B. Chance Co. Appoints L. J. Linde Chief Engineer

Leonard J. Linde, who for the past four years has been in charge of engineering for the power circuit breaker division of General Electric Co., Philadelphia Works, and who has been connected with G-E's engineering department since 1929, recently joined the A. B. Chance Co., Centralia, Mo., as chief engineer. While with the General Electric Co., Mr. Linde did considerable development work on switchgear and obtained professional recognition in the form of the Charles A. Coffin award and citation, given jointly to Mr. Linde and W. J. Lacklan in 1935 for outstanding achievements in the development and design of a secondary network protector. In 1940, he received another joint award with E. W. Boehne for outstanding work in the development and design of the Magne-blast oilless circuit breaker.

L. J. Linde

Mr. Linde is co-author of a number of technical papers and holds about 20 patents on switchgear equipment. He is a member of the American Institute of Electrical Engineers and of the American Society of Mechanical Engineers.

•

▶ L. H. URMSON, who has been with the Shawinigan Water & Power Co. since 1923 and has been safety engineer since 1928, has retired. The safety and welfare work will be carried on by D. E. ELLIS, formerly assistant distribution engineer of the commercial and distribution department at Trois Rivieres. The safety department has been incorporated into the company's

Where an inhibition frees tubes of trouble

Condenser tubes in a Liberty ship were failing after only 2 months of service. Inlet and outlet water temperatures were 83°F. and 103°F., with inlet steam temperature at 126°F. The outside surfaces showed a uniform oxide film. Inside, the cooling water had laid down a brown coating of iron oxides. Preliminary examination revealed nothing as to the cause, and samples were turned over to a Scovill engineer for thorough examination.

Laboratory inspection revealed green and white corrosion products in deep pits at several areas of the inside surface. In the bottoms of the pits redeposited porous copper was found.

REDEPOSITED COPPER GIVES CLUE

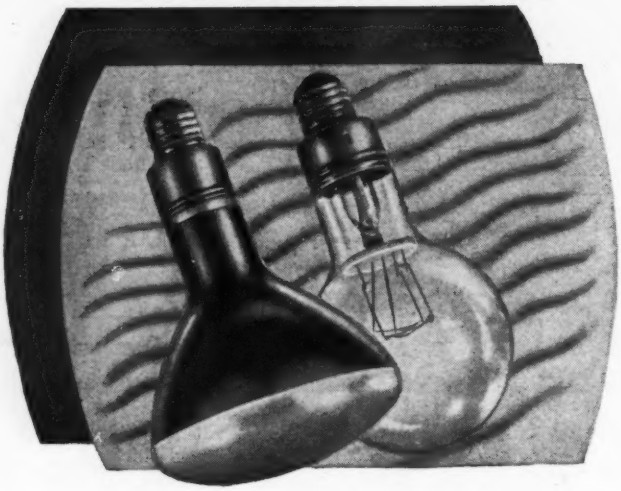
Scovill identified the trouble as "plug type dezincification," an electro-chemical corrosion which dissolves the metal and redeposits brittle copper. The condenser had been tubed with Aluminum Brass without an inhibiting agent. As recommended by Scovill, at the next retubing this condenser was fitted with Aluminum Brass tubes containing 0.04% to 0.05% of an inhibiting agent and normal tube life was obtained.

THREE SCOVILL SERVICES

Scovill *Service in Men* provides specialized advice and study on individual tube problems, as in the example above, and on installation practice. Scovill also provides two other services. *Service in Metals* includes the selection of alloys and the study, in the laboratory and in the field, of specific problems for individual customers. *Service in Manuals* offers valuable literature on condenser and heat exchanger tubes. To get your copy of our Condenser Tube Booklet, address Scovill Manufacturing Company, 24 Mill Street, Waterbury 91, Conn.

Scovill
MANUFACTURING COMPANY
WATERBURY 91, CONN.
CONDENSER TUBES
ONE PRODUCT . . . THREE SERVICES
Service in Manuals . . . Service in Metals . . . Service in Men

MIRACLE SAVINGS
NOW POSSIBLE WITH



INFRA-RED
FOR INDUSTRIAL BAKING, DRYING, DEHYDRATING AND PREHEATING

Paint finishes dried in minutes instead of hours! Lacquers baked in 4 hours instead of 18! Paper printing speeded up 76%! Production increased 40% on fabric finishing machines!

These are only a few of the many authenticated reports received from engineers in industries where Wabash-Birdseye Infra-Red Heat Lamps are saving time, money and production.

Any industry with any baking, drying, dehydrating, preheating or heat-finishing operations may well effect substantial savings through Wabash-Birdseye Infra-Red Heat Lamps. For complete information write to Wabash Appliance Corporation, 345 Carroll Street, Brooklyn 31, N. Y.

WABASH-BIRDSEYE
FIRST IN INFRA-RED

Wabash-Birdseye Infra-Red Heat Lamps come in 19 sizes of reflector, clear and ruby types with reflector lamps inside-lined with pure-non-tarnishing brilliant silver — all standard for most Infra-Red production line installations, and designed for maximum efficiency with the new scientifically engineered equipment. Write for a list of manufacturers of the latest Infra-Red equipment.

personnel organization as the health and safety division of the personnel department, under the direction of W. F. Mainguy, manager.

•

New Appointments Made by Federal Telephone

Two radio engineers have been appointed to positions in the Federal Telephone & Radio Corp., manufacturing affiliate of the International Telephone & Telegraph Corp., to head up the development of a line of home radio receivers for the company. W. P. Short was named chief engineer and H. A. Snow senior engineer of FTR's newly created home radio receiver department.

Mr. Short was formerly chief engineer of the Research Construction Co. and staff member of the Radiation Laboratory of the Massachusetts Institute of Technology, where he was assigned by the Navy to help develop radar. Mr. Snow developed the "variable mu" tube while with the Boonton Research Corp. He also developed an electronic gauge while working on production of aircraft transmitters with Foote, Pierson & Co. of Newark during the war.

E. D. VanTubergen has been appointed export sales manager to serve in a liaison capacity between the radio engineering and sales department of FTR and the export department of the International Standard Electric Corp. Mr. VanTubergen is connected with the division of the radio engineering and sales department headed by E. J. Girard, assistant vice-president of FTR.

Henri Busignies, a leader in the development of radio aids to aerial and marine navigation, has been named director of the laboratories of Federal Telephone. Mr. Busignies was formerly assistant director of the laboratories.

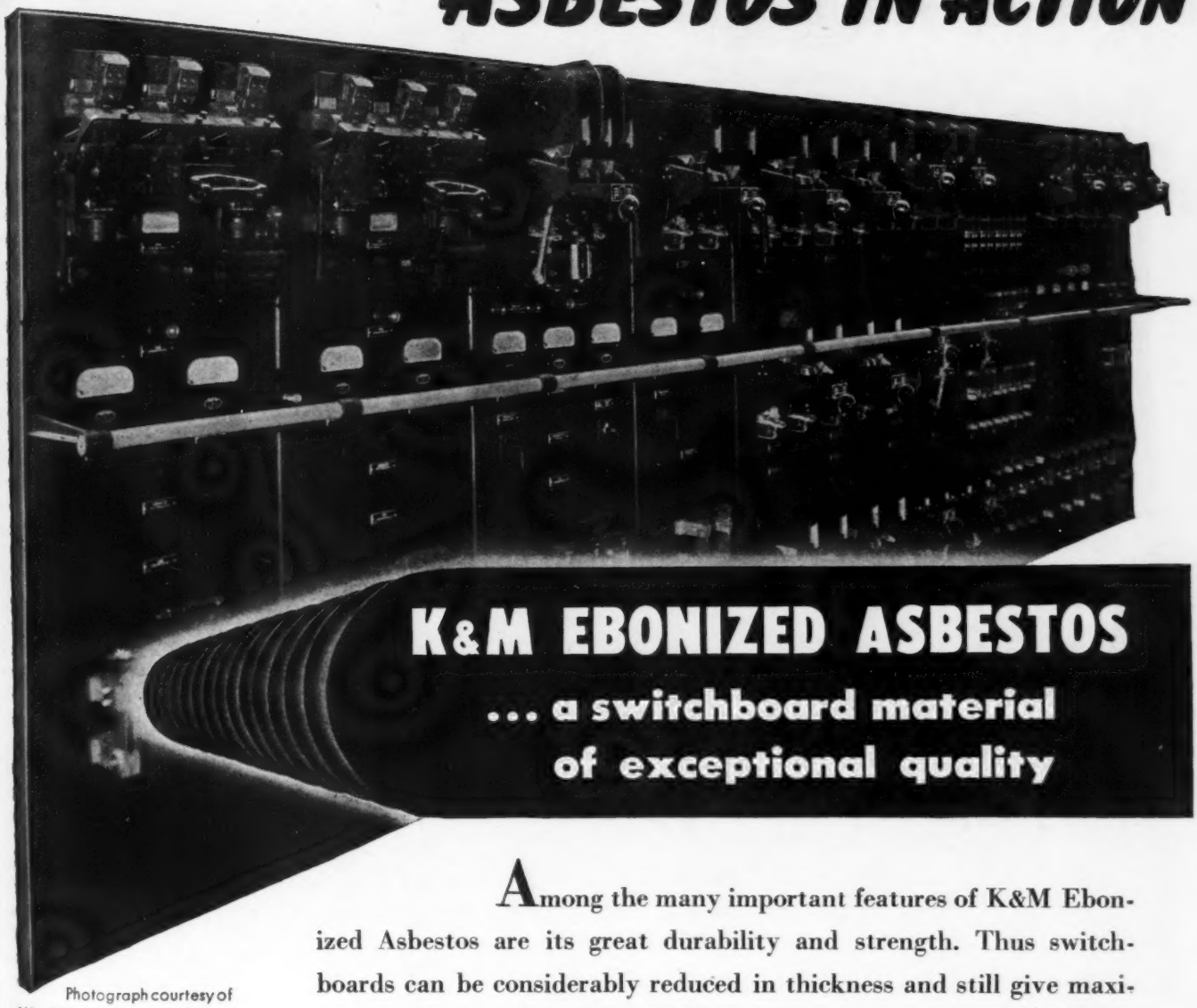
•

▶ HARRY T. WIGGINGTON of Cicero, Ill., has been named manager of the Grant Electric Cooperative at Lancaster, Wis.

▶ MELLISH LANE, Halifax, Nova Scotia, has been named acting manager of the Western Nova Scotia Electric Co., Yarmouth, N. S., succeeding the late E. H. Sollows. The Western Nova Scotia utility is a subsidiary of the Nova Scotia Light & Power Co.

▶ STANLEY M. FORD has been appointed general sales manager of the Chicago Electric Manufacturing Co. Mr. Ford has long been associated with the General Electric Co. where he was sales manager of the heating device division from 1937 until his appointment to the War Production Board in 1942. He served WPB as assistant division director of the consumer durable goods di-

ASBESTOS IN ACTION



K&M EBONIZED ASBESTOS

... a switchboard material of exceptional quality

Photograph courtesy of Wm. Wurdack Electric Manufacturing Co., St. Louis, Mo.

Among the many important features of K&M Ebonized Asbestos are its great durability and strength. Thus switchboards can be considerably reduced in thickness and still give maximum efficiency. Other features, listed below, are equally impressive.

K&M Ebonized Asbestos is made of a combination of asbestos fibre, binding cement and insulating compound, molded under terrific pressure into strong, monolithic sheets. Comes in standard or special "panel" finish . . . from ⅛" to 4" thick.

EFFICIENT FOR BUS BAR RUNS, TESTING TABLES, CABINETS, BENCH BOARDS, COMPARTMENT LININGS AND MANY OTHER TYPES OF ELECTRICAL INSTALLATIONS

•

K&M Ebonized Asbestos is specially developed to meet the technical requirements of Underwriters Laboratories, Inc. when built into an assembled unit.

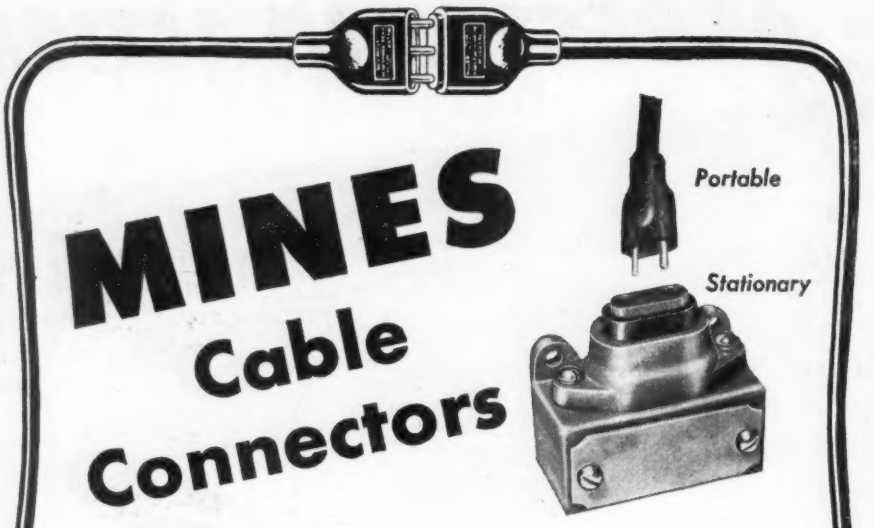
K&M EBONIZED ASBESTOS FEATURES:

- Exceptionally high dielectric strength
- Uniform density throughout
- Withstands severe shock, vibration and wide temperature variations
- Resists oil and water action
- Does not shrink, crack or bulge

Nature made Asbestos . . . Keasbey & Mattison has been making it serve mankind since 1873.

KEASBEY & MATTISON

COMPANY • AMBLER • PENNSYLVANIA



MINES Cable Connectors

Portable

Stationary

FOR POWER TRANSMISSION

SINGLE OR MULTI-CONDUCTOR

HEAVY DUTY

WATER SEALED

MOLDED RUBBER OR SYNTHETIC

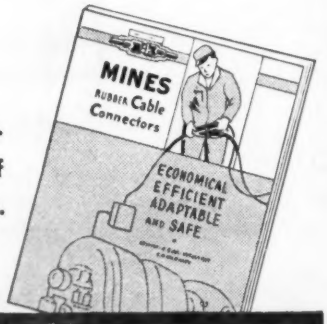
CAN BE MOLDED AT FACTORY TO SPECIFICATIONS ON YOUR CORDS OR CABLES

STAND ROUGH HANDLING AND DIFFICULT CONDITIONS

CAPACITIES FROM 5 TO 500 AMPERES

VOLTAGES UP TO 5000

CARRIED IN STOCK IN STANDARD DESIGNS AND SIZES AND CAN BE MADE UP SPECIAL TO MEET YOUR SPECIFIC REQUIREMENTS



Write for Bulletin MC-106, showing many successful applications of Mines Connectors throughout industry.

MINES EQUIPMENT COMPANY

4235 Clayton Avenue • St. Louis 10, Missouri

vision where he was a government presiding officer and administrator of many orders affecting the appliance industry. He later entered the Marine Corps and upon his release with the rank of captain was appointed to his present position.

► H. L. CUSHING, for nine years residential sales manager of the Ohio Power Co.'s southern division at Newark, Ohio, has resigned to affiliate himself with the Edison General Electric Appliance Co. at Dallas, Tex.

► WALTER S. LITTLE has succeeded George H. Sander as manager of the Public Service Co., of New Hampshire's Manchester district. He is a native of Salisbury, N. H., and joined the Public Service company in 1927. He specialized in appliance service and installation until 1941, when he became assistant to the district manager.

► RICHARD P. BALLOU has been appointed chief engineer of Federal Electric Products Co., Newark, N. J. Identified with the electrical industry for the past 25 years, Mr. Ballou's background includes affiliations with the Donegan Electric Co., Detroit; Westinghouse Research Laboratories, East Pittsburgh, and the Union Switch & Signal Co. at Swissvale, Pa.

► RICHARD H. WOOD has been appointed manager of industrial relations of the John A. Roebling's Sons Co., Trenton, N. J. Mr. Wood, who has been associated with the company for three years in industrial relations matters, was formerly an instructor in economics at Princeton University.

► A. R. FISHER has been elected vice-president of the Johns-Manville Corp. Mr. Fisher, who will assume responsibility for all mining and manufacturing activities of the company in the United States and Canada, succeeds S. A. WILLIAMS, who has been advised to take a rest. Mr. Fisher joined the company in 1923. Mr. Williams has been identified with the company for more than 42 years.

► CHARLES W. STEWART, for many years identified with the steam specialty sales field, has been appointed vice-president in charge of sales for the Clark Manufacturing Co., Cleveland. For the past 19 years, Mr. Stewart has been associated with the Hoffman Specialty Co. of Indianapolis. He will work closely with Vice-President John L. Mainwaring in extending the sales and distribution of the company's products. Mr. Mainwaring, while continuing his many contacts with the sales force and distribution system, will devote an increasing

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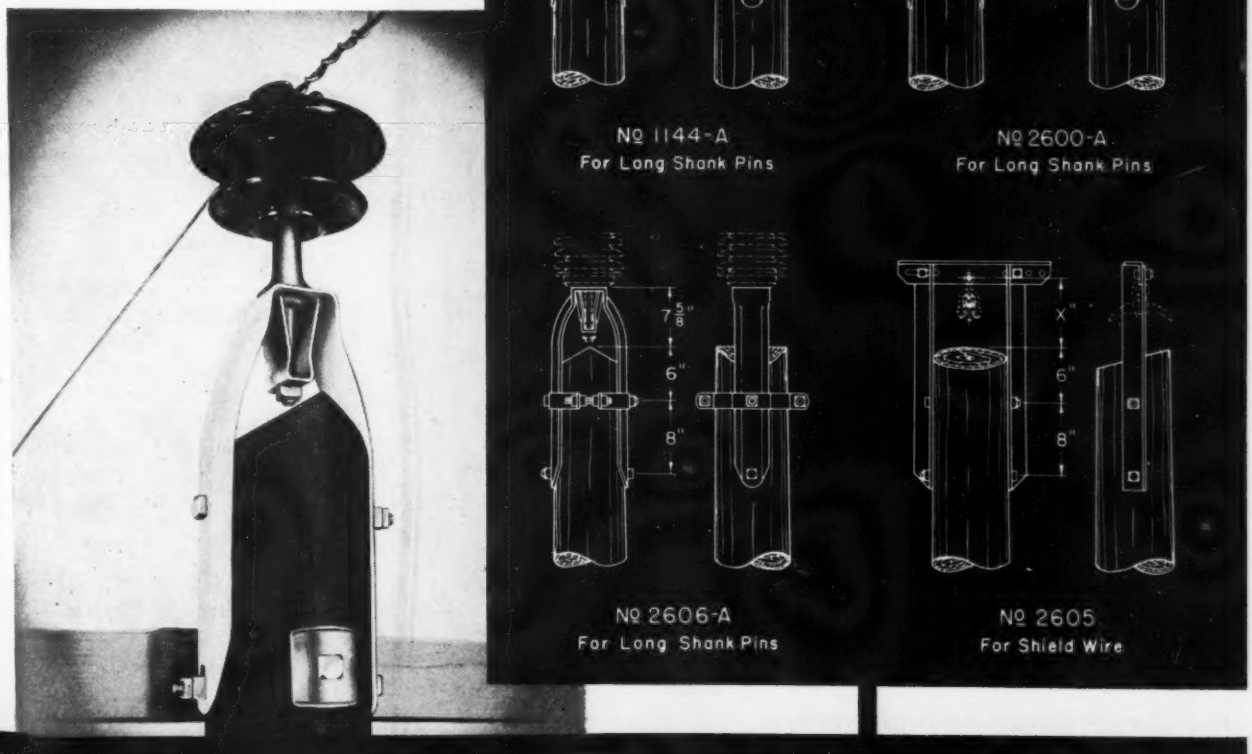
DESIGNED TO FIT YOUR NEEDS

HUGHES RIDGE IRONS are designed for strength, easy installation, economy, adaptability. They are designed to carry the load and prevent pole top splitting. All parts are of hot dip galvanized steel.

Below are illustrated a few of HUGHES RIDGE IRONS. Write today for full information and price list. Consult Hughes Engineers for your special requirements.



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Receptacles, Connectors *and* Plugs
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Ever-Lok protects against every contingency including abuse and frequent and hard usage.

For light and power circuits, 2, 3 and 4 poles, 10 to 200 Amperes.

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Complete Catalog on Request.

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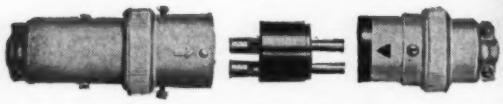

New Ever-Lok Connector with midget fuses for high cycle tools and small portable equipment.

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amount of his attention to engineering research and to product development and application. Mr. Stewart has served as president of the Steam Heating Equipment Manufacturers' Association since 1942 and has been a member of the American Society of Heating and Ventilating Engineers since 1919.

▶ HAROLD E. JOHNSON, for 25 years associated with international division of General Electric Co. in Cuba, Mexico and Europe, has been appointed managing director of Maguire Internacional, S.A., Mexican export-import subsidiary of Maguire Industries. Inc.

▶ CARL J. HOLLATZ, formerly manager of the Ken-Rad division of General Electric, has joined the Raytheon Mfg. Co., Waltham, Mass., in an executive capacity. He was at one time connected with the Westinghouse company's lamp and radio tube division, and was later associated with the Radio Corp. of America.

▶ FREEMAN A. SPINDELL has been appointed chief engineer of Browning Laboratories, Inc., Winchester, Mass. Mr. Spindell has been associated with the Browning Laboratories since 1941, where he has devoted his time to the design of radar and radar test equipment.

▶ MARSHALL B. TAFT, formerly of the Aero Division, Minneapolis Honeywell Regulator Co., has been made assistant to Henry F. Dever, president of the Brown Instrument Co., Philadelphia industrial division of the Honeywell organization.

▶ EDWARD A. ASH has been appointed as director of the major appliance division and advertising manager of the F. L. Jacobs Co., Detroit, Mich. Mr. Ash will be in charge of the company's non-automotive line, which includes the "Launderall" home laundry, electric steam irons and other appliances not yet in production. Mr. Ash has been identified with the Jacobs organization since 1940.

▶ PETER W. SMITH, sales supervisor for the Virginia Electric & Power Co. at Suffolk, is now local manager of the company at Crewe, Va.

▶ THOMAS V. POWELL has been appointed personnel director of the Hallicrafters Co., Chicago. Mr. Powell has had wide experience in personnel work, having been associated with the Ford Motor Co. for the past fifteen years.

▶ FRANK S. RYAN has been appointed advertising and sales promotion manager of the Apex Electrical Manufacturing Co., Cleveland. Mr. Ryan was formerly in the merchandise division of

341 OF THE 9,675 CAPACITOR AND RESISTOR TYPES

engineered by SPRAGUE and produced in 1944

A good measure of any supplier is his ability to meet BOTH standard and highly specialized requirements. The Sprague war-time record offers convincing evidence in both respects.

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"ADVANCE" BALLASTS EXCEL IN QUIET OPERATION, high efficiency performance, low replacement cost and long life. They permit easy installation in fixtures where only a limited space is allowed for ballasts. Designed by expert lighting engineers and approved by Underwriters Laboratories, "Advance" ballasts are the answer to all fluorescent lighting problems. LARGE MANUFACTURERS OF LIGHTING FIXTURES USE "ADVANCE" BALLASTS—so insist on this quality ballast on the equipment YOU buy.

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BLACKBURN Service Entrance CONNECTORS are so strong, durable and lasting, hence so economical, because they are made of DURONZE. This high-strength silicon bronze is 75% stronger than hard-drawn copper, and more non-corrosive than pure copper.

The circular construction of **BLACKBURN Service Entrance CONNECTORS** gives extra strength along the line of pull of the screw. These connectors will not stretch or distort when tightened—will not come loose. They're a **real** economy!

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Over 100 Conveniently-located Jobbers' Stocks

BLACKBURN Service Entrance CONNECTORS

JASPER BLACKBURN PRODUCTS CORP.
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the Westinghouse Electric Corp., Mansfield, Ohio, but after the United States' entry into the war, he was transferred to Westinghouse executive offices in Pittsburgh, where he served as chairman of the company's War Production Coordinating Committee before joining Apex.

▶ EARLE R. HOYLE has recently been appointed electrical engineer, refinery department, Sinclair Refining Co., East Chicago, Ind., succeeding the late Walton Poole. Mr. Hoyle has been assistant electrical engineer of the refinery department since 1942. He joined the Sinclair organization in 1931 as electrical engineer of the company's Houston Refinery, remaining until his transfer to East Chicago in 1942.

▶ ARTHUR I. WALLACE, formerly WPB regional utility engineer in the Chicago area has joined the AA Electric Supply Co., Chicago, as vice-president. This company, which has been serving the utility industry for 25 years, wholesales gas and electric equipment in both the distributor and appliance field.

▶ ARNOLD G. BROWN, formerly assistant manager of the pump division, Fairbanks, Morse & Co., has been appointed manager of that division to succeed John S. King, now acting manager of the company's railroad division. Mr. Brown was general sales manager of the Pomona Pump Co., when it was purchased a year ago by Fairbanks, Morse & Co.

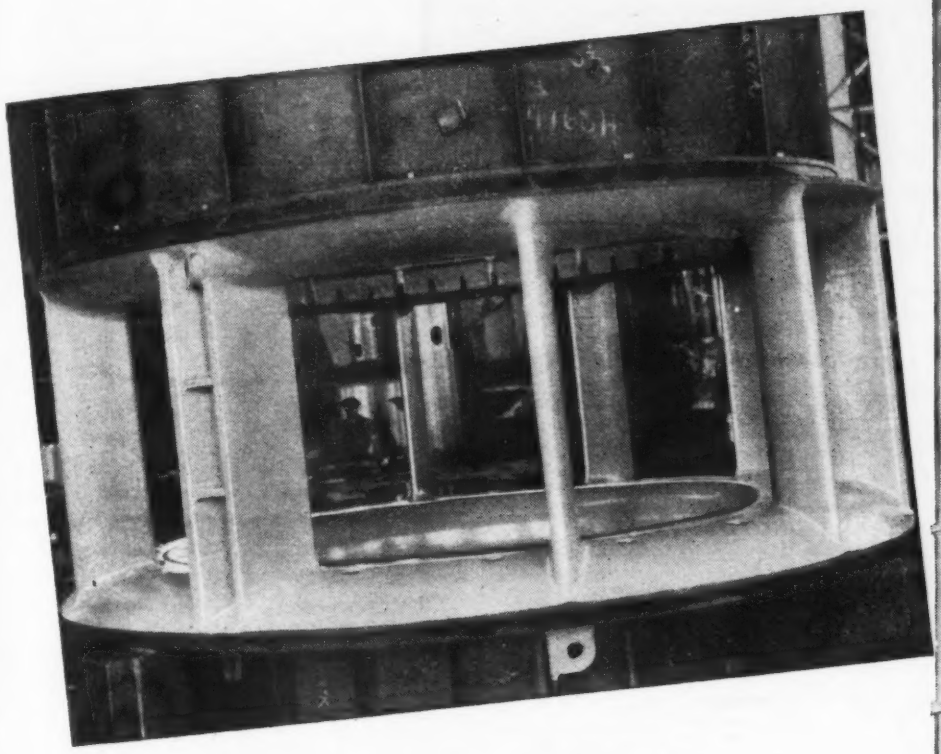
OBITUARY

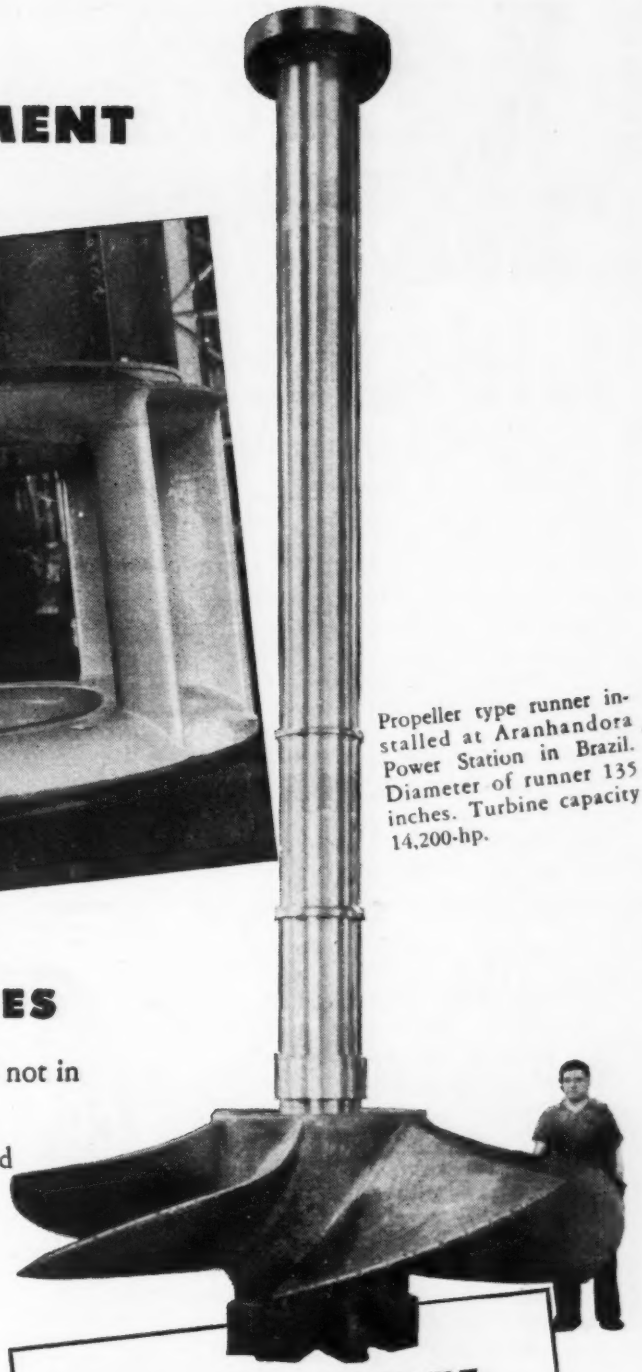
▶ DAVID S. BOYDEN, 72, former superintendent of the steam heating department of the Boston Edison Co., and past-president of the National District Heating Association and American Society of Heating and Ventilating Engineers, died at St. Petersburg, Fla., on November 26. He was educated at Lowell Institute, Boston, and retired in 1939 after 31 years of service with the company. He was widely known in the public utility field.

▶ JOHN E. GREENLAND, president and general manager of the Ontario Electrical Construction Co., Ltd., died on November 6 in Toronto General Hospital after a week's illness. Mr. Greenland was 42 years of age.

▶ ST. CLAIR SMITH, safety engineer with Ford, Bacon & Davis, died at Stamford, Conn., on November 28 in his sixty-fourth year. Ford, Bacon & Davis worked on the atomic bomb project at Oak Ridge, Tenn., and Mr. Smith, just prior to his death, had received a letter from the War Department commending him for his work at Oak Ridge.

For economical
LOW HEAD DEVELOPMENT





Propeller type runner installed at Aranhandora Power Station in Brazil. Diameter of runner 135 inches. Turbine capacity 14,200-hp.

PROPELLER TYPE TURBINES

Propeller type turbines are indicated for heads not in excess of 100 feet and in cases where water economy, at heads considerably lower than the rated output, is not of primary importance. The selection of the proper turbine, to suit the conditions of any particular installation, is essential for economical development of water power. Baldwin engineers have been solving problems of this kind for many years. Perhaps they can assist you.

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BALDWIN HAS A TURBINE FOR EVERY TYPE OF INSTALLATION

MANUFACTURING MARKETS

Hercules Plans New Plastics Laboratory

Plans for a new plastics laboratory at its Parlin, N. J., plant have been announced by Hercules Powder Co. The laboratory will serve as headquarters for the company's development and research work on plastics, and tests will be conducted there on the three plastics materials—ethyl cellulose, cellulose acetate, and nitrocellulose—produced at Parlin and other cellulose products department plants. Chemists at the laboratory will work with the company's technical service men in developing new product applications, and in helping to find answers to the production problems of customers.

The laboratory, with facilities for compounding finished plastics for testing, will be set up in such a way that customers who buy basic materials from Hercules can see new techniques applicable to their work demonstrated, and can work with the laboratory chemists on their processing problems.

The building will centralize in one laboratory the chemical and mechanical development work being done at Parlin on plastics. R. L. Stern, chemical superintendent, will be in charge, with Walter Gloor as plastics supervisor.

Plans include several constant-temperature rooms in which plastics qualities, such as flexibility, hardness and tensile strength, can be tested under specified conditions. Both cold and heat tests will be possible, with temperatures in the testing rooms ranging from minus 70 deg. to plus 180 deg. F.

The building will be T-shaped, with the head of the T one-story high and the leg of the T two stories high. Laboratories will be located on both floors. Offices, a conference room and high-temperature equipment will be on the second floor, while cold-storage rooms, electrical-equipment rooms and a machine shop will be on the first floor. Dies and machinery for producing experimental molded plastics will be located in the machine shop.

Walls will be tile-lined and floors will be concrete. Air will be filtered to insure freedom from contamination by dust and dirt. All electrical equipment will be explosion-proof. Construction of the laboratory probably will start early in 1946.

Charles H. Gant has been appointed manager of the Parlin plant.

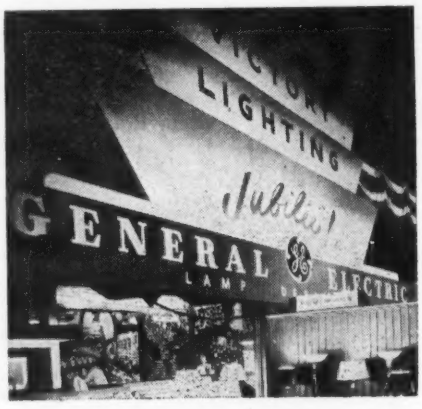
•

New Fixture Trends Shown at Exhibit

A small percentage of the 135 manufacturers exhibiting at the Victory Lighting Jubilee in New York City last week had new fixtures on display. This was due mainly to the short time interval since V-J day; nevertheless, there were sufficient post-war designs to reveal future trends.

The newer fixtures exhibited were nearly all handmade samples. These were to be found particularly in units utilizing the new circline light source and the units which combined the use of incandescent with fluorescent.

Several manufacturers exhibited ceiling and bracket fixtures that utilized circline tubes. In the greater number of these the tubes were bare, but in a few instances shielding was provided by glass or a plastic, all of which were designed for domestic use. Several manufacturers exhibited circline in both table and floor models, and it is in these that manufacturers expect circline to appear first in any appreciable quantity.



TOWER OF LIGHT—The tower of light at the Victory Lighting Jubilee held in New York as it appeared over some of the newer light sources

The newer commercial fixtures showed a definite trend toward the integration of incandescent with fluorescent. Several concerns displayed three- and four-lamp fixtures using fluorescent for general illumination and an incandescent unit, mounted at the end, for directed lighting.

Plastics continue to influence more and more designs with one manufacturer showing several all-plastic fixtures. These were stated to decrease the weight of present units by from 30 to 50 percent and to have passed tests for breakage in shipment and warpage in use successfully.

Units using glass and aluminum were also on display with glass being more prominent.

Lamps still in the laboratory and development stage were also shown and indicate that slimline and circline in colors are next on the list.

There were indications of interest in slimline as a general light source, several manufacturers expressing the opinion that it already can compete in overall cost in industrial usage.

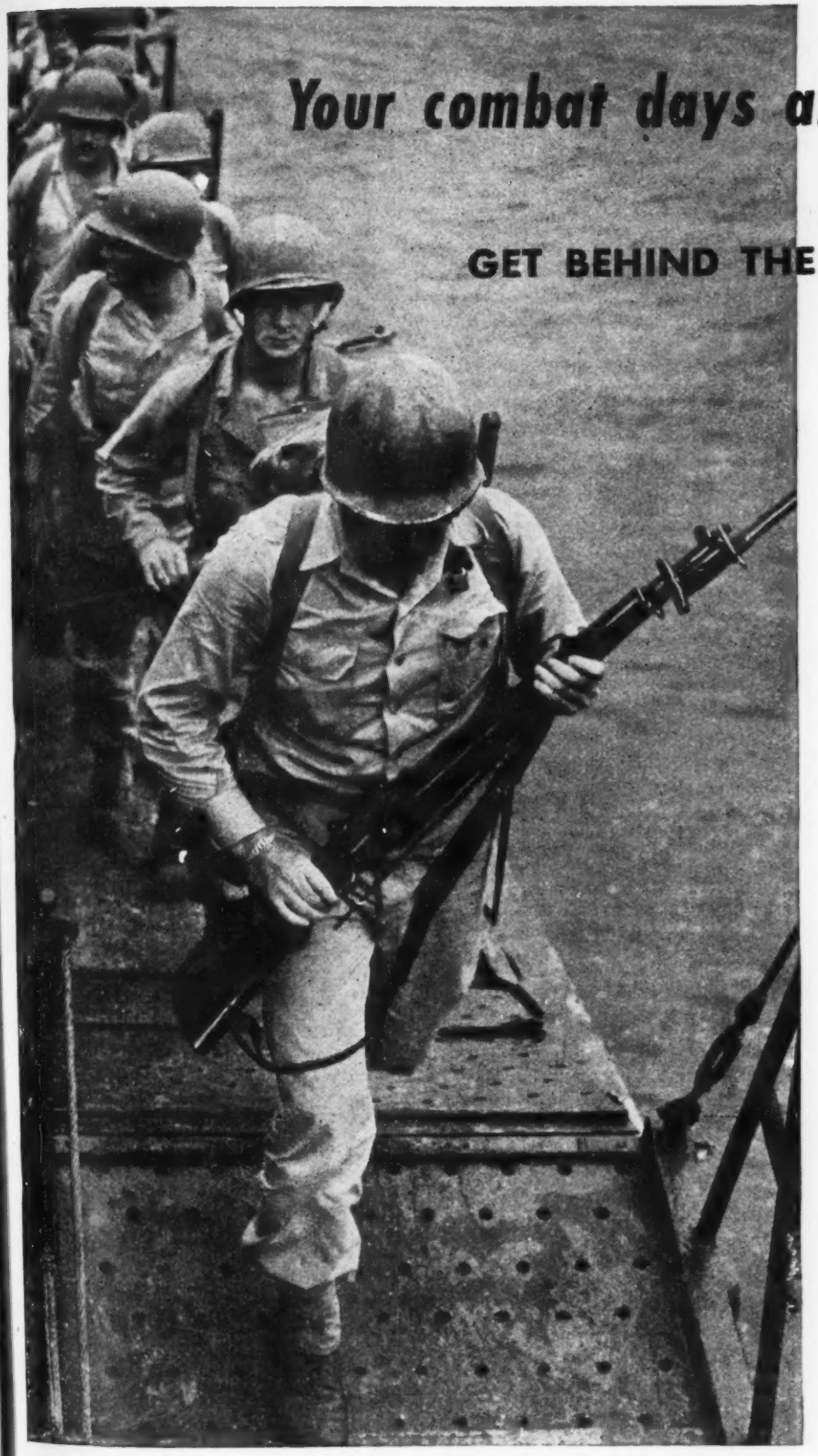
Fluorescent dominated the whole show and both the fixture and the tube manufacturers expect the already heavy demand to continue. Most concerns have been promising deliveries within 12 to 15 weeks but now are adding conditional clauses such as "if we get the material and accessories, deliveries can be expected about . . ."

•

Wiremold Sponsors "How-To-Use-It"

Post-war growth of the electrical industry has been emphasized by announcement of the Wiremold Co.'s, Hartford, Conn., contest entitled, "How-To-Use-It." The contest, which is now in progress, closes at midnight March 31, 1946, and pays off in three big first prizes: first, $500, second, $250, and third, $100. The competition will be judged on the best reports of Wiremold installations as a contribution to adequate wiring, better lighting, and more efficient utilization of electrical service. In addition, a $25 prize will be awarded for all other entries which are used in the company's promotion. The judges will be chosen from the electrical industry.

Awards will be made for entries judged as showing business-building opportunities in application, as well as good judgment in the selection and use of products in the wiring or rewiring of commercial, industrial, and other types



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ELECTRICAL WORLD

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of buildings, according to the announcement made by Wiremold.

The contest rules cover such details as description of the installation, layout data, sketches and photographs. Participants are limited to electrical contractors and maintenance men but utilities are invited to assist in bringing the contest to the attention of contractors as another means of promoting adequate wiring.

•

Manufacturers, CPA Stress Textile Need

Plans are under consideration to increase the availability of textiles for the production of insulated varnished cambric, urgently needed for the production of electrical equipment, the Civilian Production Administration has announced.

The need for the allocation of textiles for this insulating material was stressed by industry and received the support of Civilian Production Administration officials representing the copper, electrical equipment and chemical divisions at a meeting of the Insulating Varnished Cambric Industry Advisory Committee held recently.

This meeting marked the first instance where an industry advisory committee had been recalled to Washington after it had been dissolved. The urgency of the situation in this industry necessitated the recall of the committee. CPA said that formerly varnish had been the bottleneck item in the production of this cambric but that textiles were now the tight items.

The electrical industry's requirements for insulation of motors and other equipment would not exceed 20,000,000 yards of grey goods annually, which compares with a nine billion yard estimated production in 1945, industry members said.

"To break bottlenecks such as this one is one of the principal functions of the Civilian Production Administration", a government spokesman emphasized, but he added that in this instance, the allocation of materials for the electrical insulating industry would add one more item to an already exceedingly tight textile situation.

Industry members asserted, however, that part of their troubles lay in their inability to get the type of fabric needed for their purposes rather than a lack of textiles. They added that although the requirements of the insulating industry are relatively small they should be met to prevent the closing of many plants.

Accordingly, industry members were advised to present their case to CPA's textile division for immediate consideration.

Manufacturers Deny Plant Abandonment

Charges by the Congress of Industrial Organizations' United Electrical Workers that the General Electric and Westinghouse Electric companies are "abandoning" fifteen government-built war plants, costing $132,000,000, and erecting new factories in small town, low-wage areas, were denied by both companies.

James J. Matles, director of organization for the union, said in a statement that the plants being abandoned, located in industrial areas where the union is strong, "could have been converted speedily and have produced tens of thousands of radios, refrigerators, washing machines and other electrical appliances for an appliance-hungry public."

Commenting on Mr. Matles' charges, General Electric said: "After Pearl Harbor, the government as well as ourselves built factories close to our existing works, where we would have the necessary engineering and supervisory personnel to get into war production quickly...We are planning our peacetime manufacturing to meet peacetime conditions, such as accessibility to raw materials, proximity to markets, transportation facilities, costs, etc. Also we have to seek areas where help is available. In many of our present works cities we have not been able to get help to meet our requirements although we have been advertising regularly for sometime. Looking toward more efficient production, in smaller units, and therefore lower prices to customers, these plans nevertheless will provide more jobs than larger manufacturing units should. We believe that both of these goals—more jobs and lower prices to customers—are good for the country and for General Electric...The charge that we are holding up shipments and storing completed materials is simply false."

A spokesman for Westinghouse said that the company has been operating three Navy ordnance plants which, by contract terms, the Navy can "take over" at any time. "The plants are not our plants," he said. "The Navy has owned them right along, and we have simply been operating them for the Navy. There is no provision made for us to buy the plants. The Navy is now going to exercise its right to assume management. As to erecting new factories, I don't know of a single construction job going on now."

•

Elliott Terminates V-Loan

The Elliott Co., Jeannette, Pa., has announced that it has terminated its V-Loan agreement with the Guaranty Trust Co. of New York by payment in full of the balance of the outstanding loan, amounting to $3,000,000. The Elliott Co. is now free of all funded debt.

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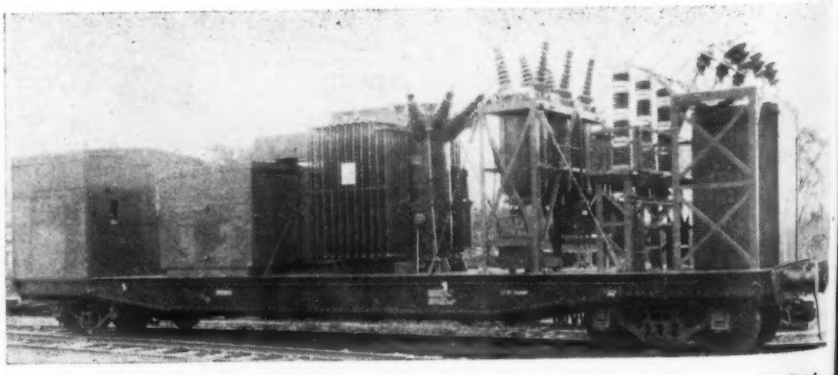
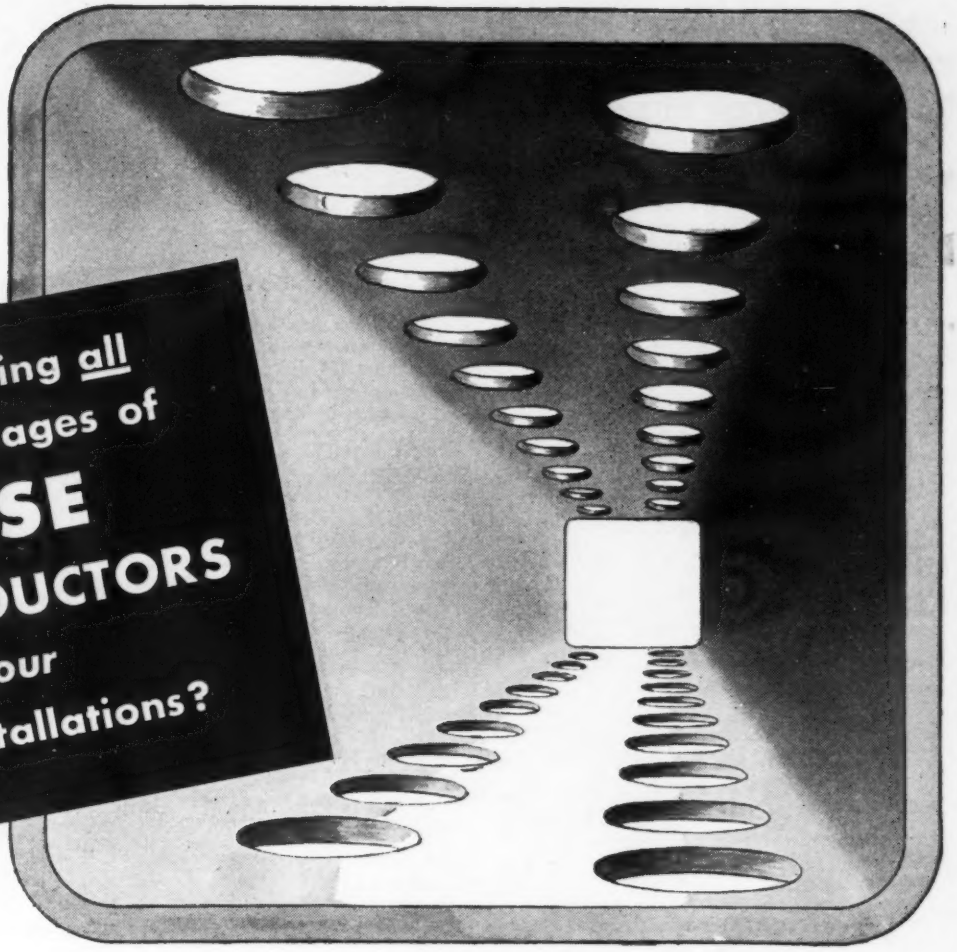
Blaw-Knox Dividend

Directors of Blaw-Knox Co. have declared the regular quarterly dividend of 15 cents and the year-end dividend of 20 cents on the common stock, both payable December 10.



SUBSTATION RIDES THE RAILS—What is believed to be the first complete distribution unit substation of the railway-type left the Pittsfield Works of the General Electric Co. recently for Russia. It was complete with wider Russian trucks, which will be installed at the port of entry after the installed standard American gage trucks have served their purpose. The substation is rated at 1,800 kva., is 3-phase, 50 cycles, and is 35,000 volts on the high side and 3,150 or 6,300 volts on transformer secondary. It weighs 111,000 lbs. and contains a 46-kv. incoming disconnect switch, an O.C.B., lightning arresters, power transformer, and three outgoing 15-kv. metal-clad switchgear circuit breakers and the necessary potential and current transformers for metering and relaying. Outgoing cable connections are made through the floor of the flat car. On one end of the car is a storage compartment for maintenance and repair tools and spare parts.



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Field Reports on Business

Labor troubles and inability to obtain material estimates for new construction are holding up a large amount of work, in which is involved a large amount of wiring supplies. The pace of holiday shopping has increased with retail sales running well ahead of the total recorded last year.

CHICAGO

The extent to which industrial expansion this year has soared ahead of last year is shown by figures for the year through November. In 1945 eleven-month period, the total dollar volume was $120,913,926, compared with only $68,825,700 for the 1944 period. Since obstacles to building at this time are still considerable, the fact that building activity is nevertheless increasing in tempo indicates a continuing growth in 1946, with its consequent boosting of electrical load and supply sales.

L. A. Goodman Manufacturing Co., producers of electrical and plastic products, plans to erect a building of 50,000 sq. ft. area at 129 West 63rd St. Conlon Corp., Cicero, is expanding its plant to increase production of household electrical devices. Offner Electronics has begun an addition to its plant. Work has started on a commercial sales building for Harry Maruc Co., makers of electrical products.

No offers have yet been received for the $180,000,000 Dodge Chicago airplane engine plant, which used some 17,000,000 kw.-hr. of electricity when in full operation. Placed on the block by RFC, the plant contains 6,430,000 sq. ft. of space, or 1,430,000 more than Willow Run.

The gain in the number of electrical permits issued in Chicago is another barometer indicating the upward trend in building over the past three-year period: In August, latest month for which figures are available, permits totaled 3,388, against 3,070 for the same month in 1944, and 2,321 for August, 1943.

NEW ENGLAND

Spotty conditions prevail in the electrical market in this district. Last week's storm damage was confined in large part to telephone disruption; about 9,300 telephones were out of service in the eastern seaboard area, and about 3,000 in greater Boston. Practically every major radio broadcasting station in New England plans changes in facilities during 1946; New Bedford, Fall River, Mass., and Norwich, Conn., stations are studying the FM and television fields. The Bell system has received government sanction to install radiotelephone facilities in Boston and will install 5 units operating from a fixed transmitter in Bowdoin Square, Boston. Boston Traveler has put in service a 40-ft. illuminated electric newscast display on the United Press building, Boston.

Labor troubles and inability to obtain material estimates for new construction are holding up a large amount of work by Massachusetts state departments which involve both wiring supplies and elevators. Municipally owned incinerators are being considered in Massachusetts and Connecticut. One project involving dryers, conveyors, and handling equipment is being studied by New Britain, Conn., officials.

Construction of a $300,000 addition to the Bradley Hospital, Southington, Conn., has been begun by Wales-Lines Co., Meriden, Conn., contractors. New England railroads are placing orders for coaches, trolley cars, and trackless trolleys with the Pullman Standard Co., Worcester, Mass. Home building applications for new construction of dwellings planned in Massachusetts for 1946 so far reach $88,082,000, according to one authority. FWA allotments for the preparation of plans for projects in New England announced last week for the New England area totalled $33,148 for an estimated cost of $846,480 including schools, recreation grounds, and water-works extensions.

PACIFIC COAST

Rail-water shipments from eastern factories have been scheduled but not received and will apparently not be a factor in decreasing landed costs on heavy items until early 1946. Heavy rainfall coupled with cold weather has created considerable demand for electric heaters, with increasing but as yet inadequate production.

Westinghouse is setting up a plant in Emeryville in East Bay district, to manufacture a line of portable wall and floor models, from 1250 to 4000 watts, under license from Wesix.

Reclamation Department budget includes $7,500,000 for canals in Delta Region for Central Valley project, and $7,600,000 for ultimate transmission lines and switchyards.

Miscellaneous construction projects include $4,000,000 of county fair buildings for various locations in northern California; a $1,500,000 hotel for Las Vegas, Nev.; awards, aggregating $971,000, for Sears-Roebuck expansion in Los Angeles and Glendale; $750,000 for various structures in Anchorage, Alaska; and a $500,000 courthouse annex and a 200-room $1,250,000 hotel expansion in Long Beach.

Bonneville System plans a 115 kv. extension into the Tillamook area of Washington, along with replacement of part of an earlier line from Salem.

NEW YORK

The leading reconversion industries should be producing by next June at a rate two and a half times as great as in 1939 and should employ about twice as many workers as in that year, according to a report on reconversion issued by the Civilian Production Administration. The report is based on data for 55 industries, including 245 war production plants and 806 factories that have been or are in the process of reconverting from partial or total war production.

For the second successive week, new financing last week was held in abeyance while investment bankers limited activities to furthering Victory Loan bond sales.

Civil engineering construction volume in continental United States totalled $59,622,000 last week, as reported to *Engineering News-Record*. This volume was 29 percent above the preceding week's volume and 66 percent above that of the corresponding 1944 week. Private construction continued to climb; public construction was 5 percent greater than the preceding week but was down 43 percent compared with last year. The week's construction brought the 1945 cumulative total to $2,051,399,000 for the 48-week period, a 25 percent gain over the similar period of 1944.

Electrical World's

42nd ANNUAL STATISTICAL ISSUE

(Jan. 19, 1946)

will present

THE INDUSTRY'S FIGURES

and what they mean

1. Figures on energy output
2. Generating capacity
3. New stations
4. Station economics, such as fuel consumption and efficiency, average hours of use, plant loading, capacity factor, etc.
5. Energy sales by classes of customers
6. Revenue by classes of customers
7. Average revenue per kilowatt-hour by classes of customers
8. The number of customers in different classes, both nationally and sectionally
9. Rural developments by numbers of customers and miles, nationally and regionally
10. Operating expenses showing operating ratio, including maintenance and wages
11. Taxes
12. Financing in terms of security issues, bonds maturing, etc.
13. The budget in terms of prime mover, transmission, distribution and miscellaneous, regionally, together with the breakdown of total investment by type of property
14. Manufacturers' sales
15. Government projects

with an interpretation of the significance of these statistics, a summarizing table of facts, a display of the highlights of the statistics, and a summary of the year's happenings in the electrical industry.

ADVERTISING FORMS CLOSE JANUARY 7, 1946

Announcing
a Three-Way CIRCUIT TESTER
GIVES QUICK "YES" OR "NO" ANSWERS

Built to withstand rough treatment ... Simplifies acceptance testing of residential and commercial wiring.

Absence of commutators, slip rings, calibrated meters, rheostats or adjustment knobs in this compact circuit tester, simplifies both operation and maintenance . . . makes it cost less than conventional circuit testers. The self-contained generator develops peaks of 250 V.A.C. and tends to assure uniform tests regardless of generator speed. It requires but one operator and minimum instruction. Why not get the complete story? Write for details today.

DOES ALL THREE JOBS

✓ ***Audible Check:***
1. Tests wire and ground insulation
2. Tests continuity of wires

✓ ***Visual Check:***
3. Determines polarity of wires*

**A special indicator attachment is available for polarity tests.*

Great American Industries, Inc.
CONNECTICUT TELEPHONE & ELECTRIC DIVISION
416 Britannia St. **Meriden, Connecticut**

Royal-ettes

#25 in a series of informative letters from a producer of Switching Equipment.

OUTDOOR AIR BREAK SWITCH

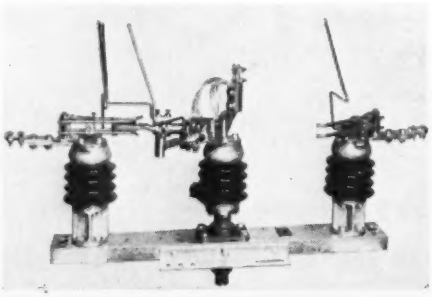
For economical switching from a load center to two sources of power supply

The Royal type DRL-2 double-throw group-operated switch provides an economical means for switching between one load center and your preferred and emergency power supply. Ordinarily two switches are required.

The DRL-2 can be mounted on a single structure.

It can be operated manually or arranged for automatic operation.

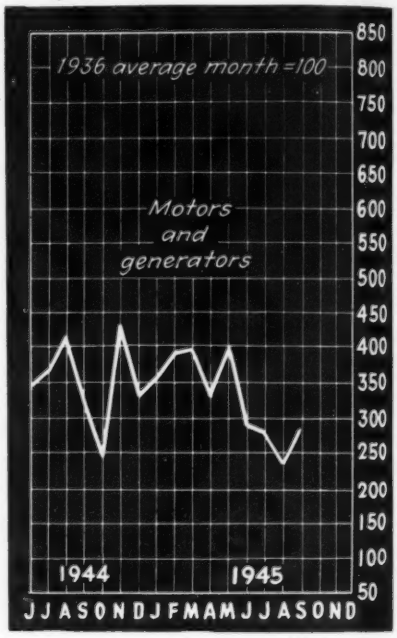
Where you have a service requirement for two sources of power supply, but the budget must be maintained, let us furnish a DRL-2.



ROYAL ELECTRIC MFG. CO. 619 E. 40th Street CHICAGO 15, ILL.

September Generator Orders Move Upward

New orders for motors and generators during the month of September moved upward, according to figures released by the National Electrical Manufacturers Association. The index compiled by NEMA advanced to 298 from 244 in August. In September, 1944, it stood at 314.0.



NEMA index, value of orders received

The 1944 monthly indexes include an adjustment for cancellations reported up to December 31. No adjustment has been made for renegotiation of contracts.

•

Pre-War Output by Mid-'46

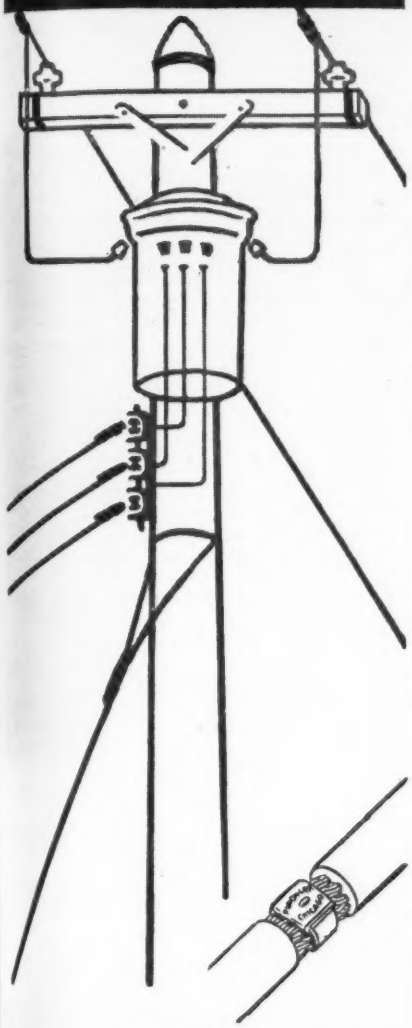
With the first electric refrigerators since April, 1942, rolling off the assembly lines of the Edison General Electric Appliance Co. at the Erie, Pa., plant, company officials predicted recently that, while production will allow consumers to view models in dealers' stores by December, there will be no consumer deliveries in volume for Christmas. Floyd M. Slasor, manager of refrigerator sales, said that by mid-1946 production should surpass pre-war output.

•

Refrigerator Prices Set

Ceilings for new household refrigerators have been established at levels that will maintain, on the average, March, 1942, prices to consumers, the Office of Price Administration recently announced. Regulations governing prices of "reconversion" refrigerators were also issued.

PUNCH-LOK
Streamlined
Banding and Splicing Method



With Punch-Lok Clamps, applied with the Loking Tool, you can make connections easily, quickly, simply, safely...without taking down wires or installations. Will withstand any normal pull strain. Many other applications for repairing, banding, splicing, tying.

Write for descriptive catalog and name of nearest distributor

Keep Buying War Bonds

PUNCH-LOK COMPANY

Dept. R, 321 N. Justine Street
Chicago 7, Illinois

Recent Rate Changes

CONSOLIDATED EDISON CO. has been permitted by the New York Public Service Commission to put into effect on December 1 temporary reduced rate schedules for commercial users. The rates will obtain for two months, pending conclusion of hearings on rate schedules designed ultimately to save consumers more than $6,000,000 a year. The commission previously had granted a reduction for residential users starting November 5, estimated to save them $2,560,000 annually.

CENTRAL NEW YORK POWER CORP. and the NEW YORK POWER & LIGHT CORP. have made an annual reduction of $1,600,000 in their electric rates, effective January 1, according to the New York Public Service Commission. The two companies, subsidiaries of the Niagara Hudson Power Corp., offered to make the reductions after the Public Service Commission had investigated the relation of their profits to the value of property used in giving service.

NORTHWESTERN ELECTRIC CO.'s new "all-electric" home rates proposed for customers in Oregon and Washington have been approved by the Washington State Department of Public Utilities. The rates were approved late in October by the Oregon Public Utilities Commissioner. In the Vancouver-Camas area of southwestern Washington the new rate gives qualified users, having both electric range and electric water heater, 300 kw.-hr. for the monthly minimum charge of $4.50. The next 700 kw.-hr. is available at a rate of six mills per kilowatt-hour, with excess use over 1,000 kw.-hr. a month at a rate of 8½ mills per kilowatt-hour. In rural areas the same rate will be charged except that the monthly minimum charge is 50 cents higher. The "all-electric" rate is designed to promote year-around use of electricity for household purposes.

KINGSPORT UTILITIES, INC., has reduced electric power rates in Kingsport. The Tennessee Railroad and Public Utilities Commission has approved the new schedule. Commissioner Leon Jourolmon said the reduction probably would amount to a decrease of approximately $2,000 per year for large industrial power users.

DALTON (GA.) city water and light utilities customers are to receive an approximate reduction of 30 cents in electric light bills, according to V. D. Parrott, Jr., superintendent. The reduction represents an annual saving of $8,000.

PACIFIC GAS & ELECTRIC CO.'s reduced rates for electric consumers in three small California towns have been approved by the California Railroad Commission. Five-year contracts signed between the company and the communities will result in savings of about 7 percent in Ukiah, Healdsburg and Lompoc.

•

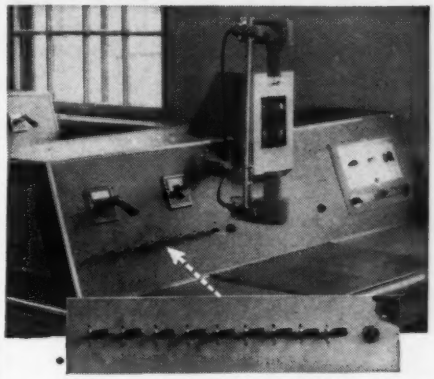
Buys British Subsidiary

Nash-Kelvinator Corp., Detroit, has purchased Kelvinator, Ltd., English subsidiary of Kelvinator of Canada, Ltd. The purchase, for $615,000, has the twofold purpose of sharply strengthening the net working capital position of the Canadian company, while at the same time providing for expansion of the British company as a self-contained manufacturing and distributing unit.

For Accurate, Convenient Meter Testing

St. Joseph Railway, Light, Heat and Power Co.

Uses MOSSMAN Heavy Duty Lever Switches



Watthour meter test panel of St. Joseph Railway, Light, Heat and Power Company showing nine Mossman Series 4101 Heavy Duty Lever Switches.

● Nine Mossman Series 4101 Extra Heavy Duty Lever Switches are used by the St. Joseph Railway, Light, Heat and Power Company of St. Joseph, Missouri, on panels for testing watthour meters. Each of these switches controls a different current value for loading these watthour meters under test.

Mossman Series 4101 Switches, with extra heavy duty contacts, are capable of handling 20 amperes, 110 volts A. C. (non-inductive) which is more than ample for a watthour meter test panel. Note the trim appearance and the ease of operation which these switches provide.

Utility engineers seeking a compact, efficient replacement for ordinary single pole, single throw knife switches for test panel use are invited to make use of Mossman sales engineering assistance.

Write for the MOSSMAN Catalog for complete data on all types of Mossman precision electrical switching components.

DONALD P. MOSSMAN, INC.
612 North Michigan Avenue, Chicago 11, Illinois

MOSSMAN
Electrical Components

For Inside and Outside

INSULATION RESISTANCE TESTING

For complete equipment with Self-contained power sources —(No tiresome cranking)—Compact—Portable

Model 201

VIBROTEST

Insulation Resistance Tester.

Sturdy construction throughout. Vibrators seldom if ever replaced. Power from 2 No. 6 dry cells producing constant potential of 500 V. Range 0-200 megohms. 2000 ohms, 150-300-600 V., AC or DC. One of 36 models.

Model 255

VIBROGROUND

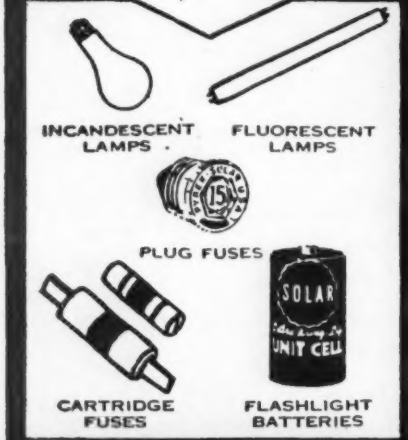
For determining resistance of ground connections.

4 ranges for extremes of dryness and moisture. Ranges 0-3, 0-30, 0-300, 0-3000 ohms. Model 251 has triple range for average ground conditions. Design efficiently excludes "strays". Controlled sensitivity. Rugged reliability. Utmost accuracy.

Send for bulletins. Also HYPOT, insulation breakdown tester. VOLTAMMETER for measuring AC voltage and amperage, etc. We recalibrate and repair instruments, any make. Engineering Service Representatives in All Principal cities.

221-C South Green St., ASSOCIATED RESEARCH, Incorporated Chicago 7, Illinois

SOLAR Electrical Products



Quotation on request

SOLAR ELECTRIC CORPORATION

WARREN, PENNSYLVANIA

Bias Tapes with

PLENTY OF STRETCH!

THEY fit snugly into all corners and crevices. Their exceptional flexibility and tensile strength are due to an Acme developed process of applying pure vegetable oil varnishes of Acme formula to highest grade cotton fabrics. Offered in bias or straight tapes, and in rolls up to 36" wide —yellow or black. Samples if requested.

The Acme Wire Co., New Haven, Conn.

Acme Wire Products

VARNISHED INSULATIONS — MAGNET WIRE COILS

Sales Opportunities

FLORIDA—Florida Power Corp., St. Petersburg, has plans maturing for addition to generating station at Inglis, with installation of equipment for increased capacity. Work will begin soon on steel frame superstructure.

TENNESSEE—Tennessee Eastman Corp., Kingsport, acetate rayon, staple fiber, etc., has authorized expansion in mills, comprising several additional buildings, with machinery and electrical equipment. Program will be carried out over period of 24 months, beginning early in 1946, with estimated cost of about $10,000,000.

INDIANA—Electric Light and Water Department, Columbia City, will have plans prepared at once for improvements in municipal steam-electric generating station, including installation of new boiler, cooling tower and other equipment. Douglass & Laramore, 327 South LaSalle St., Chicago, Ill., are consulting engineers.

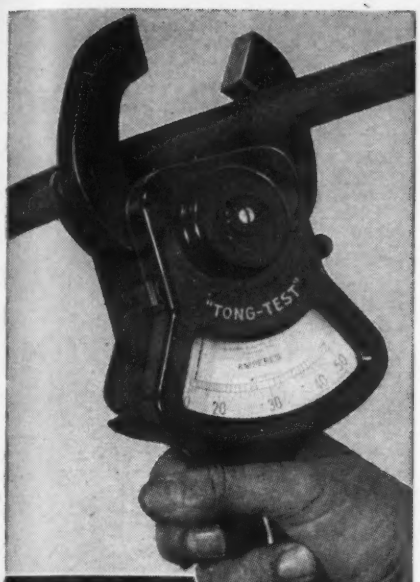
OHIO—Plaskon Division, Libbey-Owens-Ford Glass Co., 2112 Sylvan Ave., Toledo, plastic products, plans new plant on 40-acre tract of land in vicinity of present research laboratory, Glendale Ave. and line of Terminal Railway. It will comprise several multi-story buildings for resin and molding powder production, with experimental and pilot plant facilities. Machinery and electrical equipment will be installed for large output. Cost estimated about $5,000,000. Work will begin at early date. Stone & Webster Engineering Corp., 49 Federal St., Boston, Mass., is consulting engineer.

TEXAS—Electric Department, Lubbock, plans extensions and improvements in street-lighting system, including installation of new units in different parts of city. Cost estimated about $245,000. A special election to approve bond issue in that amount has been called December 11.

NEW YORK—Carrier Corp., 300 South Geddes Ave., Syracuse, air-conditioning, refrigeration and industrial heating apparatus, plans new plant in vicinity of present works, consisting of main multi-story production building and auxiliary units, with machinery and electrical equipment for large capacity. Cost reported over $3,000,000. Financing is being arranged. Proposed to carry out project in 1946.

LOUISIANA—New Orleans Public Service, Inc., New Orleans, will award contract for construction of proposed new steam-electric generating station at Downman and Dwyer Rds., early next year, with work to proceed immediately thereafter. Plant will be equipped for initial capacity of 35,000-kw.; boiler units will be equipped for natural gas fuel, with facilities for changing to oil or pulverized coal, if desired. New plant will be connected with Market St. station of company by new 110,000-volt underground transmission line, over 10 miles in all. Underground conduit will be of special construction, with cables enclosed in welded steel pipe, oil-insulated. Entire project is estimated to cost about $6,000,000.

INDIANA—Board of Public Works, Bluffton, plans immediate call for bids for extensions and improvements in municipal power station, including installation of new 1,600-kw. diesel engine-driven generator and auxiliary equipment.



Safe, even on high voltage lines.

Simple to operate.

Handy Pocket Model for small motors.

MEASURES AC or DC Current INSTANTLY

Instantaneously, by merely "snapping" the tongs around any electrical circuit, you can measure the current — BOTH A.C. and D.C. up to 800 amperes — without necessitating a break in circuit or insulation. Every electrician should have one. It's a time saver — production speeder. Weighs only 2¾ lbs. and is as simple to use as the illustration above suggests. Write today for our TONG TEST Bulletin describing its many time-saving applications.

COLUMBIA ELECTRIC MFG. CO.
4519 Hamilton Ave., N.E., Cleveland 14, O.

COLUMBIA
TONG TEST AMMETERS

NEW JERSEY—Anheuser-Busch, Inc., 721 Pestlozzi St., St. Louis, Mo., brewer, has plans maturing for new brewery on Frelinghuysen Ave., Newark; tract of about 19 acres of land was acquired several months ago. It will comprise several large multi-story buildings, with machinery and electrical equipment for heavy output. A boiler house is planned. Project is scheduled to be carried out in 1946, and will represent investment in excess of $10,000,000.

CONNECTICUT—Connecticut Light & Power Co., Hartford, plans new double-circuit, 69,000-volt transmission line from power substation at Southington to Bristol, about 8 miles distant, for increased power supply at latter place. Work will be carried out early next year. Company also will build a new 115,000-volt transmission line from Devon generating plant, Milford, to connection with present Southington-Montville high-tension line, about 28 miles.

UTAH—Electric Light Department, Nephi, has plans under way for new municipal hydroelectric power plant at Salt Creek Canyon, about 2 miles from town, estimated to cost about $72,130. New station will replace and increase output of three small obsolete plants. Caldwell & Richards, Templeton Bldg., Salt Lake City, are consulting engineers.

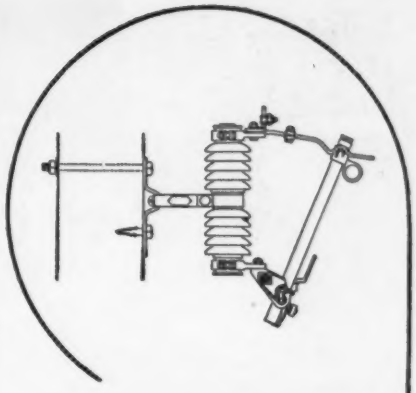
NORTH DAKOTA — Board of Directors, North Dakota State Teachers' College, Valley City, has plans under way for extensions and improvements in power plant, including installation of new steam turbine unit and auxiliary equipment. Jesse B. Harris Co., Wesley Temple Bldg., Minneapolis, Minn., is consulting engineer.

MICHIGAN—Ford Motor Co., Dearborn, has approved plans for expansion and improvements in main foundries at River Rouge plant, comprising additional buildings and interior changes, with mechanical and electrical equipment. Program will be carried out over a period of several months and is reported to cost approximately $10,000,000.

WASHINGTON—Klickitat County Public Utility District No. 1, White Salmon, plans call for bids early in 1946 for construction of primary and secondary lines, with line transformers and other facilities, in parts of Klickitat County, totaling about 320 miles. James W. Carey & Associates, Alaska Trade Bldg., Seattle, are consulting engineers. Power supply will be furnished by Bonneville Power Administration, Portland, Ore., which will build new transmission line from The Dallas, Ore., to Goldendale, Wash. Work on latter line, about 30 miles long, similarly will be carried out in 1946.

CALIFORNIA—East Bay Municipal Utility District, 512 16th St., Oakland, plans installation of motor-driven pumping machinery, with controls and auxiliary equipment in pumping plant for intercepting sewer and sewage treatment works to serve Alameda, Albany, Oakland, Berkeley and Piedmont. Cost estimated about $9,193,000. Financing is being arranged and plans are in progress.

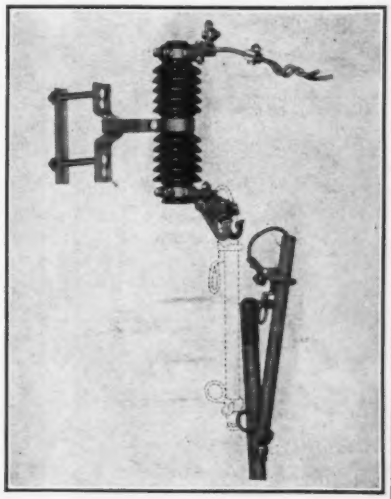
NEW JERSEY—Gibraltar Corrugated Paper Co., Inc., 8101 Tonnelle Ave., North Bergen, plans new paperboard mill on local site, comprising a main one and multi-story building and several auxiliary structures. A power plant will be erected. Entire project to cost close to $1,000,000 will be placed under way at early date. Johnson & Wierk, Inc., 415 Lexington Ave., New York, N. Y., is consulting engineer.



Fuseholders can be easily and safely removed or replaced with standard ballpoint hotsticks.

Fuseholders can't be installed backwards.

Fuseholders won't weld to upper arm during heavy short circuit.



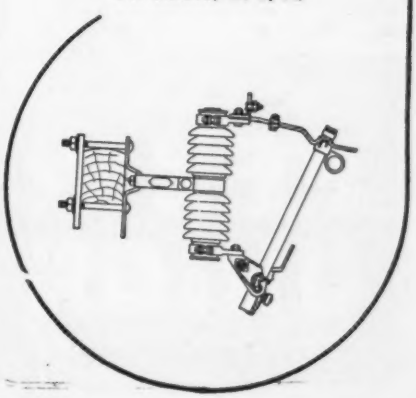
LOW TENSION OPEN TYPE DROPOUT MATTHEWS FUSWITCHES

Fusing: 100 Amperes. Rupturing capacity 2000 Amperes.

5 K. V.—7½/12½ K. V. y Grd.—15 K. V.

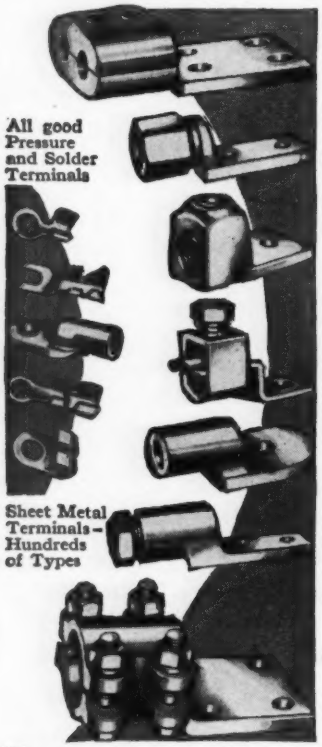
Try at our risk. Ask for Bulletin.

W. N. MATTHEWS CORPORATION
ST. LOUIS, U. S. A.



You always find the
EXACTLY RIGHT
Terminal Lug—

in the COMPLETE line
You'll see ALL good types of terminals in the Penn-Union Catalog. Shown above is the EZ; below are a few pictures giving an idea of the wide variety:



All good Pressure and Solder Terminals

Sheet Metal Terminals—Hundreds of Types

Also Tees, Taps, Straight Connectors, Grounding Clamps, etc. etc., thousands of items. And every one is Dependable, mechanically and electrically. Penn-Union fittings are the first choice of experienced users.

PENN-UNION
ELECTRIC CORPORATION
ERIE, PA.

PENN-UNION
Conductor Fittings

REA Funds Allotted; Contracts Approved

The Rural Electrification Administration has recently approved loan allotments totaling $5,465,500 to 29 co-ops in 14 states. The allotments, most of which will be used for line construction to extend electric service, include the following:

ALABAMA—Central Alabama Electric Co-op., Prattville, $456,000, which includes $20,000 for warehouse and office facilities and $23,000 for reconversion of lines.

ARKANSAS—Arkansas Valley Electric Co-op. Corp., Ozark, $372,000; Farmers Electric Co-op. Corp., Newport, $235,000; Riceland Electric Co-op., Inc., Stuttgart, $110,000.

FLORIDA—Clay Electric Co-op., Inc., Keystone Heights, $299,000; Lee County Electric Co-op., Inc., Fort Myers, $75,000.

GEORGIA—Jefferson County Electric Membership Corp., Louisville, $70,000.

ILLINOIS—Monroe County Electric Co-op., Inc., Waterloo, $78,000; Spoon River Electric Co-op., Inc., Canton, $53,000.

INDIANA—Marshall County Rural Electric Membership Corp., Plymouth, $30,000.

IOWA—Plymouth Electric Co-op. Assn., LeMars, $193,000; Adams County Co-op. Electric Co., Corning, $120,000; O'Brien County Rural Electric Co-op., Primghar, $52,500; Ida County Rural Electric Co-op., Ida Grove, $50,000.

KANSAS—C.M.S. Electric Co-op. Assn., Inc., Meade, $300,000; Norton-Decatur Co-op. Electric Co., Inc., Norton, $225,000.

MINNESOTA—Traverse Electric Co-op., Inc., Wheaton, $250,000; Wright-Hennepin Co-op. Electric Assn., Maple Lake, $200,000; Cooperative Light & Power Assn., of Lake County, Two Harbors, $25,000.

NORTH CAROLINA—Central Electric Membership Corp., Sanford, $50,000.

NORTH DAKOTA—James Valley Electric Co-op., Inc., LaMoure, $440,000, which includes funds for two substations; McKenzie Electric Co-op., Inc., Watford City, $400,000, which includes funds for substations; Williams Electric Co-op., Inc., Williston, $400,000, which includes funds for substation; Nodak Rural Electric Co-op., Inc., Grand Forks, $350,000.

OKLAHOMA—Southeastern Electric Co-op., Durant, $220,000.

TEXAS—Texas Power Reserve Electric Co-op., Inc., Austin, $142,000, to provide funds for increasing pole inventory stocks; Valley Mills Refrigeration Co-op., Inc., Valley Mills, $35,000; Tri-County Refrigeration Co-op., Inc., Eddy, $28,000.

VIRGINIA—Prince George Electric Co-op., Disputanta, $207,000.

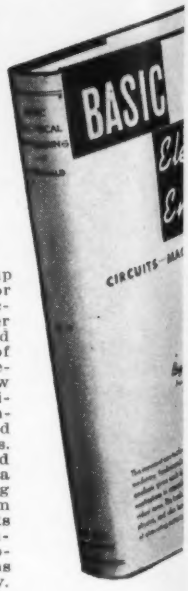
Construction Contracts Approved

ALABAMA—Central Alabama Electric Co-op., Prattville, contract to W. L. Coston & Sons, Bessemer, Ala., 116.2 miles of line; labor and materials, $124,236; engineer, Lanier Engineering Co., Washington, D. C.

ARKANSAS—Riceland Electric Co-op., Inc., Stuttgart, contract to Delta Construction Co., Clarksdale, Miss., 285.25 miles of line; labor and materials, $253,573; engineer, Southwest Electrical Engineers, Jonesboro, Ark. Clay County Electric Co-op. Corp., Corning, contract to Harvill-Byrd Electric Co., Little Rock, Ark., 116 miles of line; labor and materials, $115,241; engineer, Southwest Electrical Engineers, Jonesboro, Ark.

COLORADO—Southeast Colorado Power Assn., La Junta, contract to Snyder & John-

NOW . . .
the basic electrical engineering you need in industrial and scientific applications



Here for quick brush-up by electrical engineers or a clear, concise introduction for engineers in other fields, is a direct and fundamental treatment of electrical engineering, presenting an integrated view of circuit theory, electrical-machinery fundamentals and applications, and engineering electronics. The approach is new and well adapted to give a rapid grasp of working fundamentals, from simplest circuit concepts to an understanding of instrumentation and automatic-control applications in research and industry.

Just Published

BASIC ELECTRICAL ENGINEERING
Circuits - Machines - Electronics

By A. E. FITZGERALD
Associate Professor of Electrical Engineering
Massachusetts Institute of Technology

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The book begins with the simplest concepts, dealing with circuit analysis, behavior of certain electrical networks, transients, etc. It then goes on to a complete physical analysis of all common machine types, machine performance and applications. Various electronic tubes and circuits are discussed from the industrial, instrumentation, and control viewpoint, and in the last two chapters the treatment of individual items is correlated in a discussion of instrumentation and automatic-control applications in research and industry.

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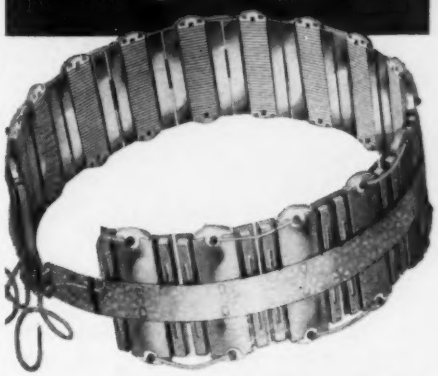

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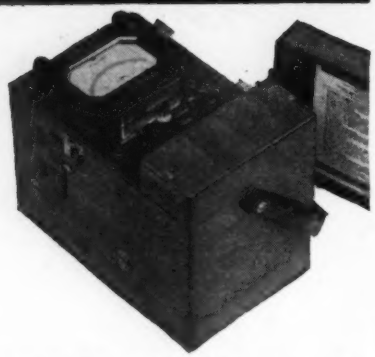

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BOOK REVIEWS

Transmission Lines. By F. C. DeWeese. Published by McGraw-Hill Book Co., New York, N. Y. 297 pages, illustrated. Price $3.50.

First, the author is well known as general engineer of Carolina Power & Light Co. Here he records the reference data and progressive steps by which one can design and construct transmission lines and subsequently predict and analyze their performance. The information is ample and explained at every point by numerical example. A unique procedure is contributed for deriving the economical conductor size in terms of loss factor, cost of energy and capital. Mechanical design is based, of course, on the latest NESC and here again, a new technique is offered for determining sag for long spans by what is termed the mean length method. There are chapters on erection of both wood-pole and tower lines. Concluding chapters calculate performance under critical loading and the corona loss on high voltage circuits.

Electric Motors and Generators. 382 pages, illustrated. Price $3.00.
Electric Protective Equipment. 243 pages, illustrated. Price $3.00.
Electrical Measuring Instruments. 284 pages, illustrated. Price $3.00.
Industrial Electric Lamps and Lighting. 342 pages, illustrated. Price $3.00.

Each of the above is part of a "Modern Electrical Series" authored by E. S. Lincoln and published by Essential Books, New York; others are in preparation. In the first two volumes listed above a unique effort has been made to translate the language and objectives of industry codification and standardization into the requirements and variabilities of applied practice. Thus the volumes are more interpretive of operating, adjusting and adapting procedures than technical texts of design and fabrication. Data and application guidance on fluorescents are a feature of the industrial lighting volume. About a third of the measurement volume is devoted to the making of surveys of circuit loading, apparatus characteristics and power factor correction in industrial plants.

Principles of Radio for Operators. By Ralph Atherton. Published by The Macmillan Co., New York. 344 pages, Illustrated. Price $3.75.

Designed for Navy radio trainees—a chapter a week—the treatment devotes one-third to basic electricity in elementary form (circuits, batteries, generators) before approaching radio via circuit elements and wave phenomena. Thence the focus is on receivers, transmitters and antennas. Generous appendices tabulate tube and socket data. This is a beginner's book in classroom pattern.

Electronics Dictionary. By N. M. Cooke and John Marcus. Published by McGraw-Hill Book Co., New York. 433 pages, illustrated. Price $5.00.

In the first place, authenticity of the contents is assured because of the collaboration of a lieutenant commander who was executive officer of the radio materiel school, Naval Research Laboratory, with the associate editor of *Electronics* in compiling this glossary. Rigorous but practicably-understandable definitions are given for over 6,000 terms that come up in the literature of radio, television, carrier, facsimile and industrial electronics. Woven in are diagrams, characteristic curves, cir-

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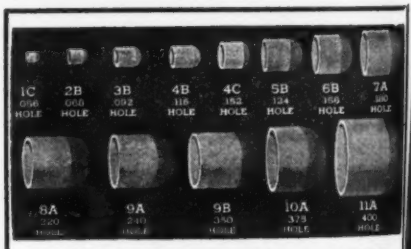

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cuits and typical fabrications along with accepted or advocated abbreviations. If desired, one can even find out what radio-thermoluminescence and a photoelectric plethysmograph are.

Electronic Equipment and Accessories. By R. C. Walker. Published by Chemical Publishing Co., Inc., Brooklyn, N. Y. 393 pages, illustrated. Price $6.00.

Technology of each type of tube and equipment is followed by a chapter assembling a wide variety of applications discussed in schematic and diagrammatic form, to the exclusion of merely photographic descriptions. Electronic devices range from thermonic valves, gas-filled valves, photronic cells, cathode-ray tubes, weak-current switchgear and delayed-action devices to the rectifiers and regulators which may be used as accessories. No book can achieve 100 percent inclusiveness in the face of current strides in electronic applications but this one does have most of the basic approaches in lucid, logical presentation.

Procedure Handbook of Arc Welding Design and Practice, Eighth Edition. Published by Lincoln Electric Co., Cleveland, Ohio, 1,312 pages, illustrated. Price $1.50.

Entirely revised to include the latest data on new arc welding methods and equipment, the new volume incorporates information that makes obsolete much of the previous literature. Sixteen new subjects are introduced, such as: New cost tables, mathematical calculations for new weld-designed structures, latest steel specifications on SAE and AISI, including National Emergency Steels, etc., underwater cutting, shop ventilation, maintenance of welding equipment, methods of testing and filler metal specifications for arc welding electrodes.

Elementary Engineering Electronics. By A. W. Kramer. Published by The Instruments Publishing Co., Pittsburgh, Pa. 340 pages, illustrated. Price $2.00.

Distinctiveness is earned by this treatment of electronic tubes, circuits and industrial applications because the author has shunned radio quite completely. Further, the author has taken unusual care to explain the phenomena that take place within the tubes so that an industrial user of electronic controls and measurements will better appreciate the potentiality and validity of what he is accomplishing. Advertisements at chapter endings could as well have been omitted.

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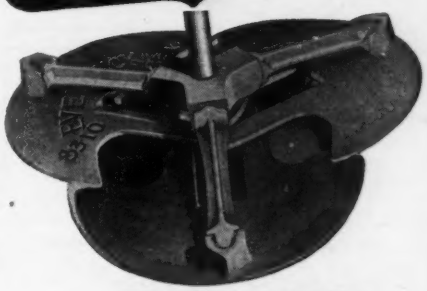

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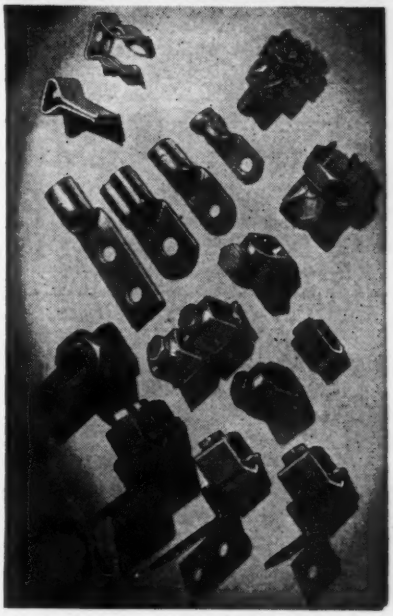

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